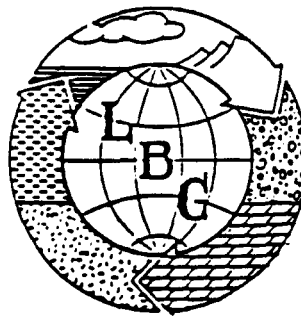




**Report of Groundwater & Soils Investigation
at
The Former Ruco Division Plantsite
Hicksville, New York**

SECTION II

Hydrogeology



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MINNESOTA**

**WILTON
CONNECTICUT**

**TAMPA
FLORIDA**

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OCCIDENTAL CHEMICAL CORPORATION
HYDROGEOLOGIC INVESTIGATION AT THE
FORMER RUCO DIVISION PLANTSITE
HICKSVILLE, NEW YORK**

**Prepared For
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August 1984**

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TABLE OF CONTENTS

	<u>Page</u>
CONCLUSIONS.	1
FIELD INVESTIGATION	3
General	3
Well Sites A and B	3
Well Site C	3
Well Site D	3
Well Site E	3
Well Site F	3
Soil Borings W, X, Y and Z	3
Soil Borings C and F	7
Drilling And Well Construction	7
Therminol Area Borings	8
Well Site E	9
Well Site D	10
Well Site A	10
Well and Soil Boring Site B	10
Well and Soil Boring Site C	11
Well and Soil Boring Site F	11
Resampling.	12
Soil Boring Site E	12
Soil Boring Site C	12
Therminol Borings W, X, Y and Z	13
Well Development.	13
Water Levels and Permeability Testing	15
Elevation Survey	15

TABLE OF CONTENTS
(continued)

	<u>Page</u>
Soil Sampling Methodology	15
Water Sampling Methodology	19
GEOLOGY	23
Regional.	23
Glacial Outwash	23
Magothy Formation	23
Raritan Formation	23
Precambrian Bedrock.	26
Plantsite Geology	26
HYDROGEOLOGY	32
Regional	32
Plantsite Hydrogeology.	36
ANALYTICAL DATA REVIEW	47
Site A.	47
Site B.	47
Site C.	48
Site D.	48
Site E.	49
Site F.	50

HRC 001 0192

TABLE OF CONTENTS
(continued)

	<u>Page</u>
THERMINOL AREA ANALYTICAL DATA	52
REGIONAL WATER QUALITY	54
RECOMMENDATIONS.	56
APPENDICES	

HPC 001 0193

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	Site Location Map.	4
2	Monitor Well Locations	5
3	Locations of Pilot Plant Borings	6
4	Geologic Map of Northeastern Nassau County, Long Island, New York.	24
5	Regional Stratigraphy.	25
6	Plantsite Geology	31
7	Ground-Water Movement and Discharge on Long Island, New York, Under Natural Conditions . . .	33
8	1979 Average Daily Pumpage (Million Gallons Per Day)	34
9	1982 Average Daily Pumpage (Million Gallons Per Day)	35
10	Water-Table Elevation Contours for the Shallow Monitor Wells, December 28, 1983	37
11	Water-Table Elevation Contours For the Shallow Monitor Wells, April 30, 1984. .	38
12	Water-Table Elevation Contours for the Deeper Shallow Monitor Wells, July 13, 1984	39

HRC 001 0194

LIST OF FIGURES
(continued)

		<u>Page</u>
13	Water-Table Elevation Contours for the Deeper Monitor Wells, December 28, 1983	42
14	Water-Table Elevation Contours for the Deeper Monitor Wells, April 30, 1984.	43
15	Water-Table Elevation Contours for the Deep Monitor Wells, July 13, 1984	44
16	Water-Level Hydrographs for Wells D-1 and D-2, April 5 to May 31, 1984	46
17	Maximum Concentrations of 1,2 Dichloroethylene, 1,1,2 Trichloroethylene, and Tetrachloroethylene (ug/l) for the period November 1975 to August 1983	55
18	Locations of Pilot Plant Borings and Proposed Additional Borings.	57

LIST OF TABLES

	<u>Table</u>	<u>Page</u>
1	Elevation Survey	16
2	Field Sampling Data	21
3	Summary of Geologic Logs	27
4	Summary of Transmissivity Test Results	40

LIST OF TABLES
(continued)

<u>Table</u>	<u>Page</u>
5 Hicksville Soil from Therminol Spill Area Analyses by Environmental Testing and Certification Corporation.	53

APPENDICES

1 Geologic Logs, Construction Diagrams and Geophysical Logs	
2 Hydrographs of Water Levels	
3 Transmissivity Test Analyses	
4 Field Notes and Photographs of Samples (bound separately)	

HFC 001 0196

WHITEMAN, OSTERMAN & HANNA
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HYDROGEOLOGIC INVESTIGATION AT THE
FORMER RUCO DIVISION PLANTSITE
HICKSVILLE, NEW YORK

CONCLUSIONS

1. Shallow ground-water flow is to the south southwest at a rate of about 0.4 foot per day. The flow in the deep monitor well zone is to the south at a rate of about 0.5 foot per day. There is a downward component of flow throughout the plantsite.

2. It is estimated that the volume of water naturally infiltrating to the water table on the plantsite is 25,000 to 45,000 gallons per day. The ultimate fate of this water is undetermined, though it is likely that the Grumman well field is the discharge point for this ground-water flow.

3. There are no major confining zones present beneath the plantsite to the depth investigated (110 feet below grade).

4. Very few of the chemicals tested were found in the soil or ground water. Substances found in the soil column were not found in the ground water in the wells at the same site. This may be due to a variety of factors including attenuation, biodegradation and dilution. Substances found in the ground water were not present in the soil at the same well site. This leads to the inference that the sources of chemicals in the ground water are not a result of activity at the surface at the site.

5. The hydrogeologic study has shown that the direction of ground-water flow is substantially different than was originally postulated based on regional flow maps and

pumpage records. The present ground-water flow pattern places the eastern portion of the Ruco plant downgradient from portions of the adjacent industrial facility rather than upgradient as expected.

6. Contaminated Wells D-1 and E-1 are downgradient from adjacent properties. The contaminants in these wells could originate both on and/or off-site.

7. There appear to be upgradient sources of trichloroethylene and tetrachloroethylene.

8. Although Recharge Basin 6 has been a suspected source of vinyl chloride monomer (VCM), no VCM was found in Well C adjacent to Basin 6. Recharge Basin 6 was the discharge basin for the pre-1976 PVC manufacturing operations. The absence of VCM may be due to the hydrogeologic effects of the cooling water recharge to Basin 4 or the possibility that Basin 6 has not contributed VCM to the ground-water regime.

9. VCM was found in both of the F wells at the southern corner of the plant. The source of this substance at this location is unknown. However, LBG is aware of ongoing research concerning the biodegradation of the family of chloroethylenes leading to the production of monochloroethylene (vinyl chloride).

10. Further investigation is necessary to determine the source and fate of organic contamination in the plant vicinity. Off-site wells, both up- and downgradient of the site, are needed to characterize water quality and to determine the directions of ground-water flow. Past operational ground-water withdrawal and recharge data from off-site are also needed to understand historical flow patterns.

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FIELD INVESTIGATION

General

The field investigation was structured to assess on-site soil and water quality in those areas which may have been effected by past waste disposal practices, as well as areas remote from plant activity to assess background conditions. The field notes generated during the program are presented in Appendix IV, a separate volume. The rationale for the investigative approach was as follows (see figures 1, 2 and 3 for locations):

Well Sites A and B: Having previously determined that ground water at the facility could reasonably be expected to flow from the north-northwest to south-southeast, LBG sited these wells to provide upgradient, background information on soil and ground-water quality.

Well Site C: Located downgradient from a formerly operating sump which received a waste stream from Plant 2 operations and surface runoff from surrounding areas.

Well Site D: Located downgradient from a former drum storage area.

Well Site E: Located downgradient from a currently operating sump which formerly received a waste stream from the Pilot Plant and Plant 1, and surface-water runoff.

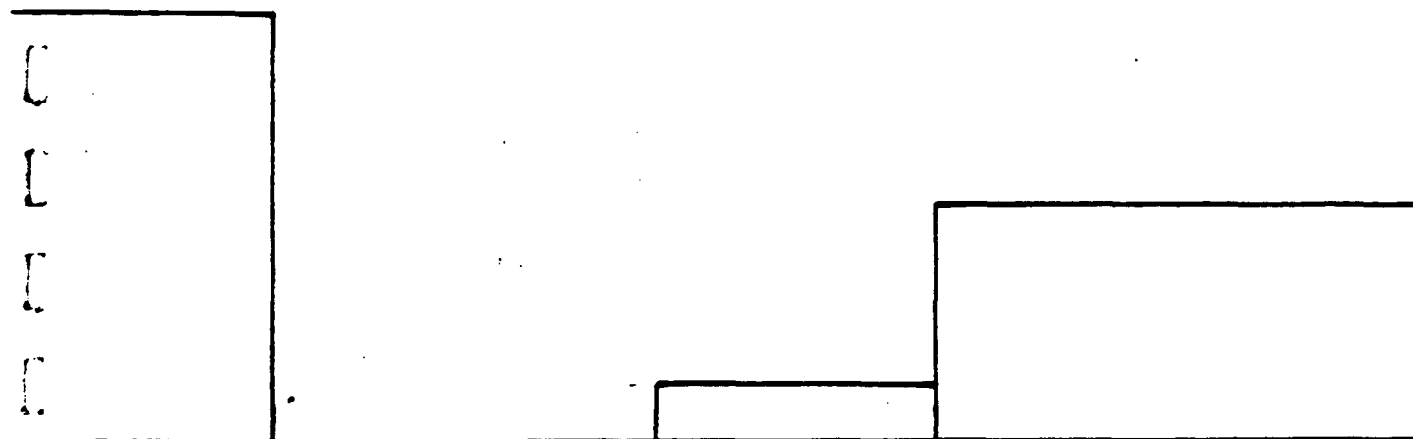
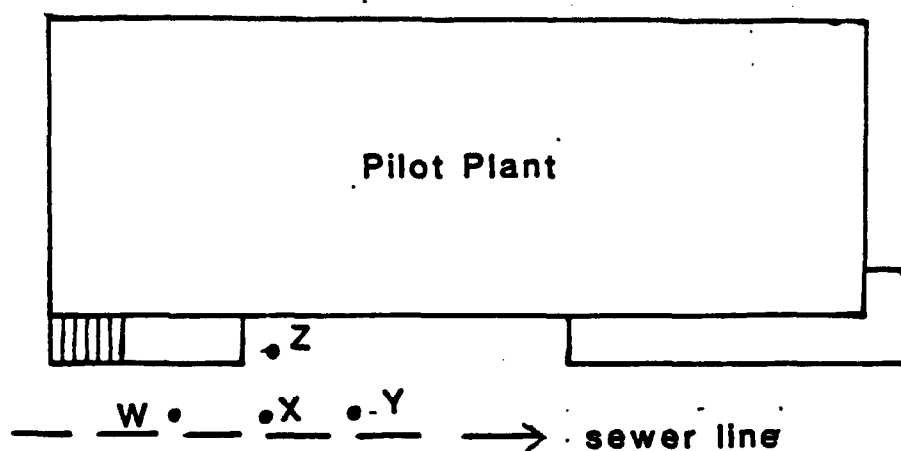
Well Site F: Located downgradient from a currently operating sump which formerly received a waste stream from Plant 1 and surface-water runoff.

Soil Borings W, X, Y, and Z: Located in an area alleged to have been contaminated with heat transfer fluids from the Pilot Plant operations (herein after referred to as the Therminol area).

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LOCATIONS OF PILOT PLANT BORINGS

1 inch = 20 feet



Plant #1

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Soil Borings C and F: The DEC had requested that the wells in these locations be completed in the sump bottoms. Because the sump at Site C is due to be filled and the sump at Site F is currently in use, this would have been impractical. For these reasons, soil samples were obtained from these sumps from the bottom/
surface to the water table, and the wells were installed on the edges of the sumps.

The DEC had originally requested well pairs with screens set in the bottom of the Glacial aquifer and at the top of the Magothy aquifer. Field results indicated that the Glacial Formation was unsaturated. Therefore, well pairs were completed with the upper screen straddling the/
water table and the lower screen set opposite the next lower/
water-bearing zone.

Drilling and Well Construction

All of the wells and test borings were drilled by the cable-tool method and were installed by R. H. Lauman and Associates of Bayshore, New York. The cable-tool method involved driving casing to a desired or predetermined depth and then cleaning the sediments out of the casing. In the unsaturated formation the cleaning involved adding water to the casing and removing the slurry by means of a flap-valve bailer which was raised and lowered. In saturated formations water was not added unless a heavier water column was needed to suppress heaving sands. If the formation was composed of consolidated or semi-consolidated materials, or contained many large rocks or boulders, a solid drill bit was used to break up the material prior to bailing. In some loose formations the casing was advanced simply by bailing the material.

The bailer was emptied into a wooden trough which directed the sediments and water into 55-gallon drums for transport off the site. Some spillage was unavoidable

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during this process and plastic sheeting covered with Speedi-Dry was spread in the work area when contamination was suspected.

All of the casings were steam cleaned prior to and between uses. A sample was obtained at the beginning of the drilling program by pouring laboratory-supplied water through several sections of the 12-inch casing after cleaning. Lubricants for the casing joints were used sparingly and care was taken to avoid introduction to the borehole. Water introduced to the wells for clean-out purposes was obtained from the municipal water supply line and was always taken from the same hydrant located in a non-process area. The water was transported to the drill sites in clean 55-gallon drums. Two samples of this water were taken, one prior to the investigation and one at the end.

The wells were constructed of 2-inch, 10-slot, Johnson stainless steel wire-wound screens and 2-inch steel casings. Although these materials were steam cleaned prior to arrival at the site, it was observed that there were still some light oils in the casings. A sample was obtained by pouring laboratory supplied water through a representative 20-foot length of the casing during the program. No lubricants were used when coupling the well components.

The outer casings were withdrawn as the annular spaces were backfilled with sand pack or grout. Except for the first grout interval at Well Site E, all grout was pumped through a tremie pipe to the desired depth. Sand pack material was poured down the annulus. The wells were completed by installing 8-inch steel protective casings with locking caps over the well couples.

Therminol Area Borings: The initial field activity at the site consisted of obtaining soil samples at the Therminol area, located at the southwest corner of the Pilot Plant. It was thought that the soil in this area may have been contaminated with polychlorinated

HRC 001 0202

biphenols resulting from discharges of the generator heat transfer fluids. This initial pattern of soil borings was meant to assess the areal and vertical extent of any such contamination.

The initial boring, Site Z, was completed in the corner formed by the building and the steps at the point most likely to have been affected by the spillage. The remaining three borings were located radially away from Site Z, ten feet from the corner (figure 3). ~~These initial borings were completed to 5.5 to 6.5 feet below present grade~~ by taking continuous split-spoon samples. The boreholes remained open after sample acquisition and no casings were used. The borings were backfilled with clay and capped with the broken asphalt and stone base material.

Well Site E: This was the first well site drilled. It was drilled by driving 12-inch casing to 60 feet in 5-foot intervals and cleaning out the formation materials. Split-spoon samples were taken at 5-foot intervals to 60 feet. At 48 feet below grade oily contaminants appeared in the bailed material. Samples were taken and transmitted to Hooker Chemical Corporation and drilling was suspended pending analysis of the materials for health and safety reasons. When drilling resumed at the site, the drillers were instructed to wear protective clothing and face shields.

When the casing was cleared to 60 feet below grade it was determined that the water table was at 54.5 feet below grade. Assuming that any lighter-than-water phase contaminants would be isolated by the 12-inch casing, LBG decided to switch to 8-inch casing for further drilling. Clean-out from the 8-inch casing continued to exhibit oily material to about 65 feet. Thereafter, the oil did not appear and obvious odors became less strong with depth. The 8-inch casing was

HRC 001 0203

terminated at 69 feet in order to isolate the upper screen zone.

At this point, 6-inch casing was introduced to the hole and advanced to 103 feet below grade. A gamma-ray geophysical log was run in the hole and screen settings were determined based on this log and the geologist's log. These logs and the well construction diagrams are shown in Appendix I. The hole was backfilled with a cement/clay mixture to 91 feet below grade and the lower screen was set from 75 to 90 feet. Sand pack was introduced around the screen to 71 feet and a cement/clay mixture was added to 66 feet. The upper screen was set from 46 to 66 feet, sand packed to 33.5 feet, and the remainder of the annulus was grouted to the surface.

Well Site D: During the drilling activity at Site E it became evident that installation and withdrawal of the 12-inch casing was difficult and time consuming. It was decided, therefore, to initiate this next site with 8-inch casing and to advance it to the bottom of the upper screen zone. Six-inch casing was then driven to the bottom depth. The screens were set from 86 to 91 feet and 45 to 65 feet below grade.

Well Site A: This well was drilled by driving 8-inch casing to 70 feet and driving 6-inch casing to 118 feet below grade. The screens were set from 105 to 112 feet and 54 to 67 feet below grade.

Well and Soil Boring Site B: During the period of inactivity at Site E the program was continued by completing some soil boring and sampling work. This included driving 6-inch casing at Site B for obtaining split-spoon samples. The boring was advanced to 60 feet below grade (the water table was at 58.62 feet)

HRC 001 0204

taking split-spoon samples at 5-foot intervals. The hole was then backfilled with a cement/clay slurry while the 6-inch casing was withdrawn.

When the drilling crew returned to this site for well installation, 8-inch casing was driven to 70 feet below grade and 6-inch casing was driven to 104.5 feet. No split-spoon samples were taken at this time. Screens were set from 86 to 104 feet and 49 to 69 feet below grade.

where?
Well and Soil Boring Site C: Also drilled during the hiatus at Site E was the soil boring in the sump at Site C. This was a 6-inch hole drilled to 52 feet below the sump bottom with split-spoon samples obtained at 5-foot intervals. The boring was backfilled with a cement/clay mixture while the casing was withdrawn.]

Well Site C was located on the berm between the shallow sump (now inoperative) and the currently operating cooling water sump. The well site is about 20 feet from the soil boring site. No split spoons were obtained from the well site. The 8-inch casing was driven to 70 feet and the 6-inch to 124 feet. The gamma logger did not function on the day this hole was completed and the screen zones were picked on the basis of the geologist's log. Screens were set from 114 to 124 feet and 50 to 70 feet below grade.

Well and Soil Boring Site F: The soil boring in the sump bottom was also drilled during the inactivity at Site E. The sump bottom is 16 feet below grade and the 6-inch boring was advanced to 45 feet below the sump bottom. It was backfilled with a cement/clay mixture.

Well Site F is located to the south of Soil Boring F on the sump rim. ~~Split-spoon samples were obtained from the surface to 22 feet below grade.~~ In order to isolate any potential contaminants in the

water-table area, 12-inch casing was again used at this site and driven to 50 feet. Eight-inch casing was driven to 70 feet and 6-inch to 113 feet. A split-spoon sample was obtained from 51.5 to 53.5 feet below grade.

Screens were set in this hole from 93 to 111 and 46 to 66 feet below grade. When the final section of 12-inch casing was withdrawn, however, the 2-inch well casings became locked in the 12-inch casing. This caused them to snap off at 64 feet and 20 feet below grade. A loose cement mix was poured down both 2-inch casings to seal the site in as sound a manner as possible.

A second well pair was then installed 11 feet to the northwest by driving 8-inch casing to 70 feet and 6-inch casing to 115 feet. The screens were set in this replacement hole from 90 to 110 feet and 47.5 to 67.5 feet below grade.

Resampling

Because of questions concerning the analytical procedures employed on some of the soil samples obtained during the field program, "duplicate" samples were obtained from two well sites and from the Therminol area.

Soil Boring Site E: A 6-inch soil boring, located about 5 feet east of Well Site E was completed to 60 feet. Soil samples were taken at all of the depths sampled at the initial well site, including the "hold" samples (not for immediate analysis). This boring was backfilled with sand to 33.5 feet to avoid introducing grout into the screen zones. The remainder of the hole was filled with a cement/clay mixture.

Soil Boring Site C: A 6-inch soil boring was drilled about 5 feet from the initial boring and split-spoon

HRC 001 0206

~~samples were obtained at 5, 25, and 50 feet below the~~
~~sump bottom.~~ These were the depths of the initial
samples which were analyzed. No "hold" samples were
obtained. This boring was filled with sand to 33.5
feet and then grouted to the surface.

Therminol Borings W, X, Y, and Z: Soil Borings were
made within one foot of the original borings; Because
the analyses on the first set of samples indicated low
levels of PCB's in the bottom sample interval it was
decided to sample the replacement borings to a depth of
10 feet in order to obtain analyses free of PCB's.
Samples were again obtained from an open hole (using a
hand auger to clear the material) to about 7 feet.
Thereafter, 8-inch casing was installed and driven
ahead, and cleaned out by adding water and bailing.
These borings were backfilled with clean fill and
capped with cement.

Well Development

Obtaining turbid-free water was of prime importance to
the field investigation because of the disagreements with
the DEC concerning filtration of the samples. Occidental
Chemical Corporation and LBG both believe that analyses of
well water should be made on samples which contain no earth
materials (clay or silt) since these materials are not
transported through the aquifer under normal flow condi-
tions. Also, these small particles have a high affinity for
attenuating some contaminants and their inclusion in a water
analysis would be misleading. The turbidity generated in
pumping a well is due to an artificial condition and does
not reflect natural ground-water movement. The DEC was
concerned that filtration of the water samples could alter
the constituent concentrations which actually occurred in
the water.

HRC 001 0207

Considerable effort was extended, therefore, in developing the wells to a turbid-free state, thereby satisfying both parties. Development was performed by two methods; bailing and airlift. Initially it was expected that only the bailer technique would be used to avoid aeration of the formation water. However, the amount of time needed to develop the wells was prohibitively long.

Wells E-1 (shallow) and E-2 were developed by bailer using the cable-tool drilling rig. Thereafter, a pump rig was used for bailer development. Wells C-1, D-1 and F-1 were developed using this rig. However, it was determined subsequently that oil from the rig was coating the bailer line. These wells were then swabbed with clean rags to remove the grease and surged and pumped with the compressor to remove residual contamination. Wells A-1, A-2, B-1, B-2, C-2, D-2, and F-2 were developed with air-lift only. Well E-2 was also developed with air. Development duration, methods and yield are shown on the well logs.

Air-lift development was done by forcing air down a one-inch rigid pipe and allowing the air to raise the water up the 2-inch casing. A fitting at the top directed the water to 55-gallon drums. The airline was held above the screen in the deep wells, but was in the screen in the shallow wells to gain maximum submergence (the water table is in the screens of the shallow wells). As expected, the compressor used for development introduced a small amount of oil to the air stream. A sample of the oil was obtained by bubbling the compressor air in a 55-gallon drum of water, and then skimming some of the oil film from the top.

The intensive well development resulted in only one well sample (C-1) requiring filtration due to suspended earth materials. The water sampling section of this report provides the results of turbidity meter readings.

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Water Levels and Permeability Testing

Water levels were taken from time to time throughout the field program and are presented in a later section of this report. All measurements were taken with a weighted steel tape cleaned between measurements. All readings were taken from the top of the 2-inch casings.

Permeability testing was performed on all of the shallow wells using a submersible pump capable of pumping a maximum of 1.25 gpm (gallons per minute). The pump and hosing were cleaned between tests using the procedure outlined in a later report section. The tests consisted of measuring drawdown and recovery during and after the 15-minute pumping cycle. Results are presented in the Site Hydrogeology section of this report. Tests were not performed in the deep wells because the pumping rate was not great enough to cause measurable drawdown in the wells.

Elevation Survey

Elevations were determined to the hundredth of a foot by the Peter J. Van Weele Company of Islip, New York. Elevations were obtained for: the top of the 2-inch casings at all 12 monitor wells, the top of the manhole covers for the three former plant supply wells, the two sump borings and a reference point at the Therminol area. The elevations are shown on table 1.

Soil Sampling Methodology

Most of the soil samples obtained during the field investigation were taken with split-spoon samplers. The exceptions were the uppermost samples at Therminol Borings W and X and at Replacement Therminol Borings W and X which were obtained by hand using clean gloves. Other exceptions were samples obtained from the driller's bailer or trough, which included the following:

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TABLE 1
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Elevation Survey

Well #	Elevation
A-1	137.52
A-2	136.73
B-1	132.65
B-2	132.64
C-1	135.62
C-2	135.60
C-2 Test Boring	127.40
D-1	132.37
D-2	132.22
E-1	131.96
E-2	131.68
F-1	131.79
F-2	131.56
F Test Boring	113.83
Well No. 1	131.19
Well No. 2 Ruco Production Wells	129.83
Well No. 3	132.06
Reference elevation at concrete step of metal building	130.56

All elevations refer to the Nassau County Datum.

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S 021ES005A0 - this sample was taken from a driller's jar marked "E 06/23/83 0' to 5.0' ditch", because the on-site DEC representative took a sample of this material; it was sent as a hold sample in case the DEC analyzed it and used it as evidence.

S 028ES048A0, S 029ES050A1, and S 060EW054A1 - these samples were taken from the trough and driller's bailer, respectively, to characterize the apparent contamination at Well Site E at the 48 to 54-foot depth; they were obtained to provide a safety protocol for further drilling.

S 090FS-40A0 and S 092FS-45A1 - these samples were taken from the driller's trough at Well Site F because the on-site DEC representative took a sample (58 to 65-foot depth range below grade); it was felt that a duplicate analysis should be available should DEC attempt to rely on this sample.

S 091FS-41A0 - no sample was obtained, though the DEC attempted to segregate small lumps of clay, which had an odor, from the rest of the material in the driller's trough. The jars, however, were contaminated by the process and the number sequence had to be maintained.

These samples, while they may be indicative of gross parameters, were not obtained in a scientifically valid manner. The driller's bailer and trough were not cleaned prior to taking the samples, and the ditch samples could be selectively picked over instead of being random.

The split-spoon samples were taken ahead of the casing to obtain undisturbed sediments. However, as stated previously, the method of drilling involved adding water to the casing to bail the soil/water slurry. It is likely that the soil sampled would have been moistened, and perhaps rinsed

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by infiltrating clean water. Also, the split spoon often had to be passed through the column of water standing in the casing which could have contaminated the split spoon. However, most of the water that was added to the borehole was retrieved by the bailer and the above processes should not have had a deleterious affect on sample quality. This situation did not occur for samples taken above 7 feet in the Therminol area or for the uppermost samples at the well sites and soil borings.

The samplers used were 18 inch by 1 1/2-inch ID steel split spoons containing a sample retaining basket. On most occasions it was necessary to obtain two or more split spoons from the same depth interval to satisfy the volume requirements of both the State laboratory facilities and the laboratory contracted by Occidental Chemical Corporation. In some instances the stony nature of the Upper Glacial Formation, as described later, caused small sample recovery. Where multiple samples were needed from the same depth the split spoon was positioned in different areas in the casing. Generally, there was sufficient area inside the 12-inch or 8-inch casing to obtain at least three split-spoon samples in the same depth interval. Because of sample volume problems, the sampler was often driven 2 feet instead of 18 inches.

The samplers were always cleaned between uses with the following procedure:

- 1) wire brush and clean water scrub;
- 2) spray with methanol, hexane and then methanol again; and,
- 3) spray rinse with clean water.

When taking more than one sample from the same depth interval the split spoon was only scrubbed and rinsed.

For samples not being split with the DEC, the material in the split spoons was photographed and described and then

transferred directly from the split spoon to the sample jars. Split samples were segregated by two methods. When the material appeared to be homogeneous the material was taken directly from the split spoon and put in the two containers in alternating one-inch segments. If the material was heterogeneous the samples were composited and mixed on Teflon sheeting and then split. In all cases, every effort was made to keep split samples uniform and maintain minimum air exposure. Photographs were obtained of most of the split-spoon samples. The photographic record is contained in a separate volume.

Water Sampling Methodology

All of the monitor wells installed were sampled during the period from January 30 to February 7, 1984. The two-man field sampling crew was able to sample one well cluster per day, including field blanks, cleaning processes and filtration when applicable. ~~The wells were evacuated with a 1 3/4-inch electric drive, submersible pump containing a Viton stator.~~ This pump is capable of delivering a maximum of 1.25 gpm for 15 minutes and then requires a 15-minute cooling period between pumping cycles. The discharge tubing consisted of three 25-foot lengths of 3/8-inch Teflon connected by two 6-inch internal copper sleeves.

~~At least four volumes of standing water in the wells were removed prior to sampling.~~ All of the samples were taken directly from the pump except for the volatiles. ~~Volatile samples were taken by stainless-steel bailers with Teflon check valves lowered on new cotton rope. For comparison purposes, volatile samples were taken at Wells E-1, F-1 and F-2 through the pump as well as with the bailer.~~ Although the bailer was lowered slowly into the water column in the well, the samples appeared to be more turbid with more settleable solids than the pumped samples. This was probably due to well agitation and/or bailer contact with the casing.

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Readings taken during well evacuation included temperature, turbidity, specific conductance and hydrogen ion concentration (pH). These data along with pumped volumes, are given in table 2, and are shown in the order that the wells were sampled. The turbidity readings, coupled with visual observations, were used to determine the need for filtration. Well C-1, though its turbidity value was not very high, had visually observable sediment and was filtered with a pressure filtration unit (except for the volatile samples). Well E-2 had a high turbidity reading as well as, suspended solids and was also filtered. None of the samples from the other wells were filtered. (Well F-1 had a high turbidity reading due to entrained gas and was not filtered.)

The bailers were cleaned between samples using rinses of water, methanol, hexane, methanol and water in that order, and were wrapped in Teflon-coated foil. Ropes were changed after sampling each well. The submersible pump and tubing were cleaned internally by pumping 4 gallons each of water, soapy water, 5 percent acetone solution in water, and then water again. Externally, the pump, tubing and electric line were wiped down with methanol and water while being lowered into the well. After sampling Well Cluster E, the Teflon tubing was discolored by a substance pumped from Well E-1. The tubing was, therefore, swabbed internally with hexane prior to the normal cleaning procedure.

Pump blank samples were obtained between Well Clusters A and B, C and D, D and E, and E and F. These were obtained by pumping laboratory-supplied millipore water through the pump and tubing and into the sample containers. The volatile containers were filled by rinsing the cleaned bailers with laboratory-supplied GC/MS water.

The filtration unit was cleaned by rinsing the pressure vessel and blowing the rinse through the apparatus. Rinses were of water, soapy water, water till free of soap, methanol, hexane, methanol and several clear water final rinses.

HRC 001 0214

TABLE 2

OCCIDENTAL CHEMICAL CORPORATION
FORMER RUCO DIVISION PLANTSITE
HICKSVILLE, NEW YORK

Field Sampling Data

Well #	1984 date	Volume of water in well (gals.)	Volume removed* (gals.)	Turbidity (NTU's)	Temperature (°C)	Specific conductance (umhos/cm)	pH	Visual appearance
A-2	01/30	9.0	48.8	0.5	11°	120	7.0	clear
A-1	01/30	1.8	22.0	2.7	12°	300	6.8	clear
B-2	01/30	8.3	43.9	1.5		240	7.1	clear
B-1	01/31	2.7	17.1	1.0		220	7.9	clear
C-2	02/01	11.0	61.0	0.5	11°	170	7.5	clear
C-1	02/01	2.6	18.3	2.5	12°	110	7.5	suspended sediment
D-2	02/02	6.1	30.5	0.9	12°	200	6.7	clear
D-1	02/02	2.0	30.5	1.3	11°	240	6.1	clear
E-2	02/03	6.1	42.7	3.5	18°	280	8.8	green tinge; second phase fluid; entrained gas
E-1	02/03	2.3	22.0	1.2	17°	180	6.7	clear, with second phase floating on discharge
F-2	02/07	9.1	43.9	4.3	16°	400	6.2	entrained gas; some second phase floating on discharge
F-1	02/07	2.4	24.4	0.9	16°	290	6.4	less gas than F-2; second phase floating on discharge

* Based on 1.22 gpm

HRC 001 0215

The filter paper that was used to filter Sample E-2 was split between LBG and DEC. The LBG portion was put in a volatile organics analysis vial and shipped to the lab.

HRC 001 0216

GEOLOGY

Regional

The geology of Long Island consists of Quaternary age Glacial deposits overlying Cretaceous age coastal plain sediments with a basement of Precambrian metamorphic bedrock. The regional geologic setting is illustrated by figures 4 and 5 which show the surficial geology and cross sectional stratigraphy. The stratigraphy at the Ruco plantsite (from top to bottom) is as follows:

Glacial Outwash: Lying unconformably on the Magothy Formation are glacio-fluvial outwash deposits of Quaternary age. These sediments were deposited by glacial meltwater originating about three miles to the north at the terminus of the Ronkonkoma ice sheet, and consist of stratified and lenticular beds of gravel and sand. This formation is about 40 feet thick at the plantsite, occurring from the land surface (130 feet above sea level) to about 90 feet above sea level.

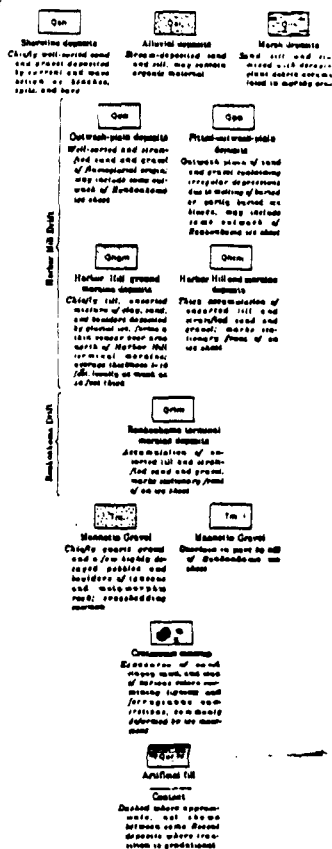
Magothy Formation: This Upper Cretaceous formation lies unconformably over the Raritan clay and is also composed of marine deposited, stratified, coastal plain sediments. The sediments are primarily fine sand, clayey sand, silt and clay but also may contain discontinuous lenses of coarse sand and gravel. The basal portion of the formation contains more coarse-grained material. At the plantsite it is about 680 feet thick with the upper surface being at about 90 feet above sea level. The upper surface of this formation has been disturbed by Glacial activity.

Raritan Formation: These Upper Cretaceous age coastal plain deposits lie unconformably on the bedrock and consist of two members. The lower member is the Lloyd

HRC 001 0217

PREPARED IN COOPERATION WITH THE
NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS AND THE
NEW YORK STATE WATER RESOURCES COMMISSION

EXPLANATION



GEOLOGIC MAP OF NORTHEASTERN NASSAU COUNTY, LONG ISLAND, NEW YORK

SCALE 1:40 (1990)

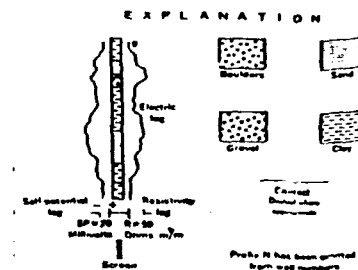
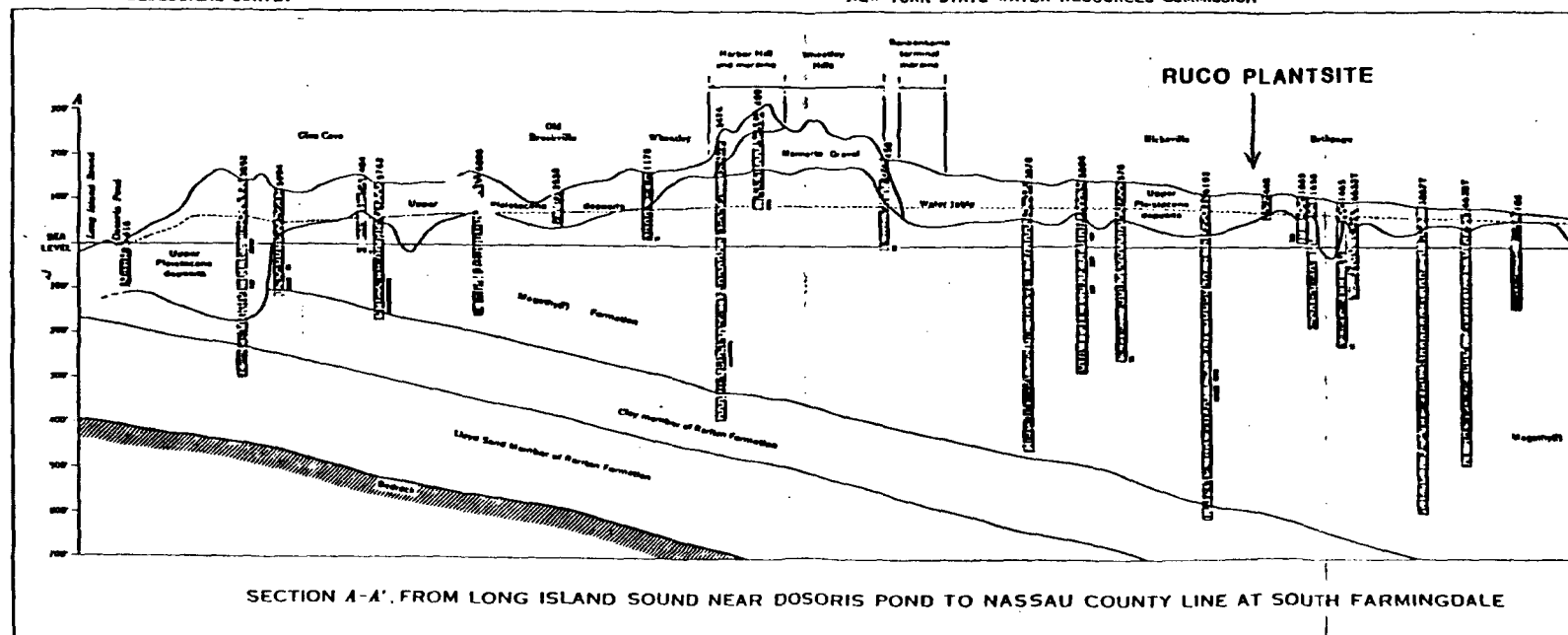


HFC 001 0218

WHITEMAN, OSTERMAN & HANNA

FORMER OCC PLANTSITE
HICKSVILLE, NEW YORK

REGIONAL STRATIGRAPHY

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEYPREPARED IN COOPERATION WITH THE
NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS AND THE
NEW YORK STATE WATER RESOURCES COMMISSIONWATER-SUPPLY PAI
PLATE 3

1 MILE

sand, the top of which is about 750 feet below sea level. This is a stratified deposit of sand, gravel, sandy clay, silt and clay generally occurring in discontinuous and lenticular beds. The upper member is the Raritan clay which is composed primarily of silt and clay, but which has some lenses of sand and clayey sand. At the plantsite this member is thought to be about 160 feet thick, with the upper surface occurring at 590 feet below sea level. The top of the clay member dips to the southeast at about 60 feet per mile.

Precambrian Bedrock: Although no wells in the plant-site vicinity have penetrated to bedrock, it is projected to be about 1000 feet below sea level. Where it has been encountered, primarily along the Island's north shore, it is composed of highly weathered schist grading to more competent rock below about 50 feet. The bedrock surface dips to the southeast at about 80 feet per mile.

Plantsite Geology

The geologic and geophysical logs for the boreholes drilled during the field investigation at the plantsite are presented in Appendix 1. Summary logs are presented in table 3. Four geologic units were identified during the field investigation. The uppermost formation, as indicated in the Regional Geology section, is composed of glacial outwash sediments ranging in thickness from 36 to 47 feet. There is generally little to no soil cover over this very coarse-grained material. The formation consists of gravel, fine to coarse sand, cobbles and traces of silt. It is brown to tan in color.

At the base of the Glacial deposits is a 4 to 7-foot "transition zone" which is composed of fine to medium tan to red sand with traces of silt and clay. This may be a basal glacial deposit, or may represent disturbed or "reworked"

PRC 001 0220

TABLE 3

OCCIDENTAL CHEMICAL CORPORATION
FORMER RUCO DIVISION PLANTSITE
HICKSVILLE, NEW YORK

Summary of Geologic Logs

Site A:

0 foot - 40 feet	Coarse upper glacial: Fine to coarse sand; gravel; some cobbles; trace silt, tan.
40 feet - 46.5 feet	Reworked Magothy (transition): Fine to medium sand, trace gravel; tan-red.
46.5 feet - 70 feet	Magothy: Sand, fine to medium with streaks of multi-colored clay, sandy clay, clayey sand.
70 feet - 74 feet	Km*: Sand, fine to medium; trace yellow silt.
74 feet - 89 feet	Km: Sand, fine to medium with streaks multicolored clay, sandy clay, clayey sand.
89 feet - 109 feet	Km: Sand, fine, tan; traces and streaks of clay, clayey sand, sandy clay; gray, red, white.
109 feet - 116 feet	Km: Sand, fine to medium, tan; trace red and gray clay.
116 feet - 118 feet	Km: Clay, sandy clay, clayey sand, multicolored.

Site B:

0 foot - 45 feet	Coarse upper glacial.
45 feet - 50 feet	Reworked Magothy? Transition?, or Magothy; sand, very fine to fine, buff and gray; some multicolored sandy clay.
50 feet - 60 feet	Km: Clayey sand; sand, very fine to fine with multi-colored clay streaks.
60 feet - 72 feet	Km: Sand, very fine, tan; traces multicolored clay and sandy clay.
72 feet - 80 feet	Km: Sand, very fine, trace silt, orange.
80 feet - 104 feet	Km: Sand, very fine, trace silt; gray-tan.

* Km = Magothy Formation

HRC 001 0221

TABLE 3
(continued)

OCCIDENTAL CHEMICAL CORPORATION
FORMER RUCO DIVISION PLANTSITE
HICKSVILLE, NEW YORK

Summary of Geologic Logs

Site C:

0 foot - 45 feet	Coarse upper glacial.
45 feet - 50 feet	Reworked Magothy; Magothy; or transition. Sand, very fine to fine, tan; trace clayey sand and gravel.
50 feet - 55 feet	Km: Sand, very fine to coarse, gray and tan; with some multicolored sandy clay and clayey sand.
55 feet - 60 feet	Km: Clay and sandy clay, multicolored; streaks fine sand.
60 feet - 70 feet	Km: Sand, very fine to fine interbedded multicolored clay, sandy clay.
70 feet - 85 feet	Km: Clay, gray; some sandy clay, gray, tan, red.
85 feet - 104 feet	Km: Sandy clay, gray, tan, yellow and black.
104 feet - 124 feet	Km: Sand, very fine; gray and tan.

Site D:

0 foot - 36 feet	Coarse upper glacial.
36 feet - 40 feet	Transition: Sand, fine to medium with some coarse, some gravel; traces of clay, red, white, pink.
40 feet - 54 feet	Km: Sand, fine to medium, tan with streaks multi-colored clay, sandy clay.
54 feet - 64 feet	Km: Sand, fine to medium, tan; trace red and gray clay, sandy clay.
64 feet - 85 feet	Km: Sand, very fine grading to silt to silty clay, light gray; streaks clay, yellow and gray.
85 feet - 95 feet	Km: Sand, very fine to medium, red-tan (coarse at bottom).
95 feet - 100 feet	Km: Silty clay, red-brown.

HRC 001 0222

TABLE 3
(continued)

OCCIDENTAL CHEMICAL CORPORATION
FORMER RUCO DIVISION PLANTSITE
HICKSVILLE, NEW YORK

Summary of Geologic Logs

Site E:

0 foot - 37 feet	Coarse upper glacial.
37 feet - 44 feet	Transition: Sand, fine to very coarse, gray and tan; some streaks clay, tan and gray.
44 feet - 47 feet	Km: Sand, fine to medium, gray; trace gray clay.
47 feet - 50 feet	Km: Sand, fine to coarse, gray, trace gray clay.
50 feet - 61.5 feet	Km: Sand, fine to medium, gray; streaks clay and silt, gray, tan.
61.5 feet - 72 feet	Km: Sand, medium to very coarse, grading to very fine to coarse; gray; some silt and clay.
72 feet - 103 feet	Km: Sand, very fine to fine, gray, some silt and clay.

Site F:

0 foot - 40 feet	Coarse upper glacial.
40 feet - 45 feet	Km: Sandy clay, gray with gray silt and clayey sand.
45 feet - 50 feet	Km: Silt, olive; some sands, clays and sandy clays, gray.
50 feet - 67 feet	Km: Sand; fine, fine to coarse, and fine to medium; with silt; brown, olive, tan, gray; generally grades coarser with depth to sand, fine to very coarse with gravel, silt, and clay.
67 feet - 82 feet	Km: Sandy clay, clayey sand with silt; olive and gray
82 feet - 110 feet	Km: Sand, fine, silty, olive and gray.
110 feet - 113 feet	Km: Sand, medium, tan.
113 feet	Km: Clay, gray and tan.

HRC 001 0223

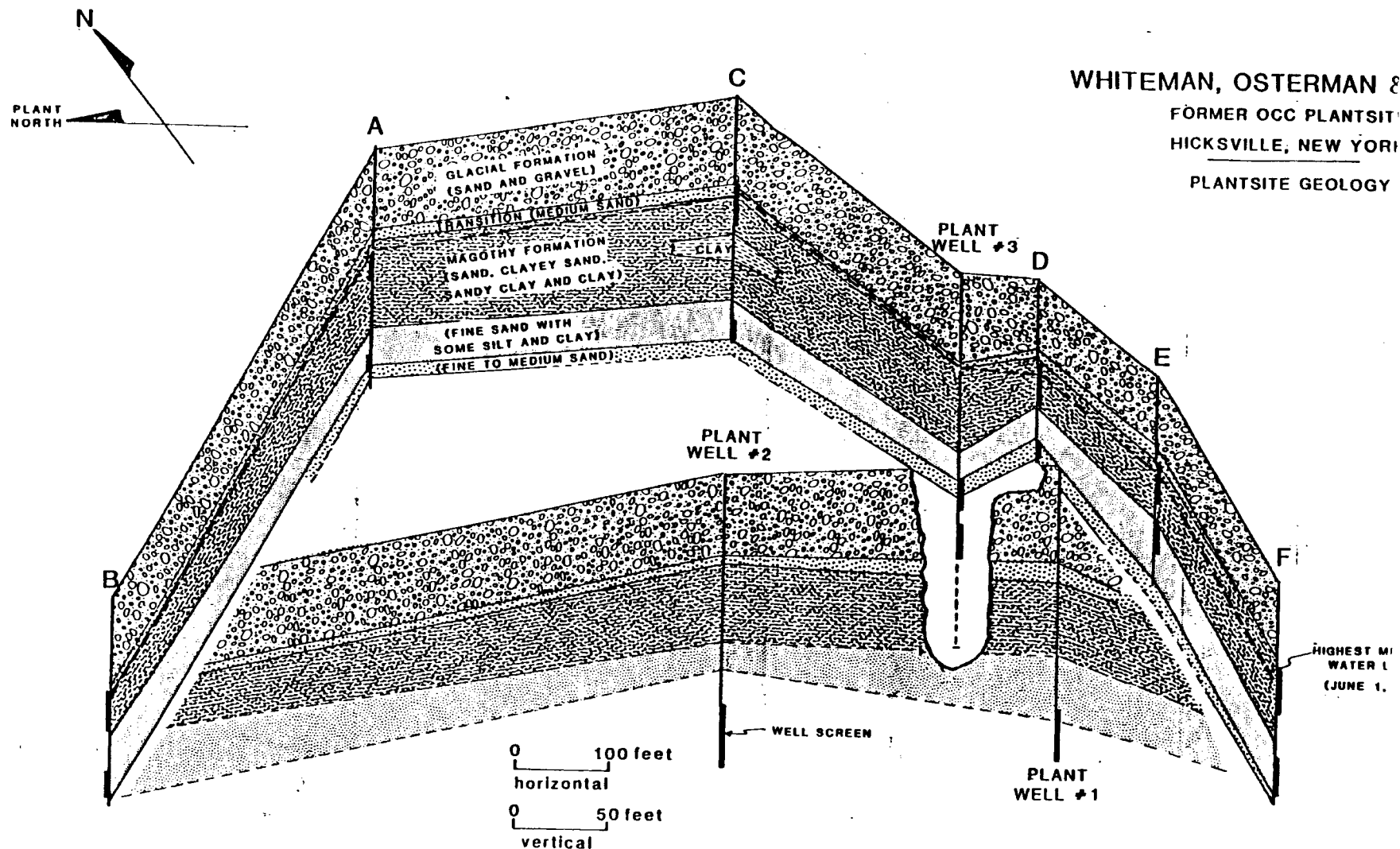
Magothy deposits. This transitional zone was not encountered at Site F.

The Magothy Formation lies directly below the transition zone and is typically composed of fine to coarse sand, clayey sand, sandy clay, silt and clay. The sediments occur in thin lenses and display a wide variety of colors. The sands are generally gray, tan and olive with some yellow and orange, while the clayey materials are red, white, tan and gray. Due to the lenticular nature of this formation it is generally not possible to correlate the individual beds from well to well. This is especially true in the upper 20 to 50 feet of the formation. Below this, however, there appears to be an areally extensive zone of very fine gray, tan and olive sand which is described in all of the well logs, and which is about 20 to 30 feet thick. Figure 6 is a fence diagram which illustrates the stratigraphy at the plantsite.

Below the very fine sand unit there generally occurs a few feet of fine to medium tan sand, followed by clay. However, the logs of the former plant supply wells do not indicate any areally or vertically extensive clay units occurring in the first 175 feet below the plant.

There is a considerable amount of iron oxide in the 20 to 50-foot depth range which generally occurs as staining on the sediments, but which also occurs as iron nodules and as a matrix in thin lenses of semi-consolidated sandstone and conglomeritic sandstone. At Sites A, B, D, and F, iron oxide was observed at about 65 feet in depth, and at Sites A, B and C it was observed in the 70 to 90-foot depth range. Apparently, much of the iron in the upper 20 feet of glacial material has been leached out and redeposited at lower depths. The consistent occurrence at 65 feet may represent the historical low ground-water level.

HRC 001 0224



HYDROGEOLOGY

Regional

All of the fresh ground water on Long Island is derived from infiltration of precipitation. In general, infiltrating ground water on the north shore and in mid-island flows vertically downward and horizontally to the south. The south shore is the discharge area where water flows upward and horizontally to the Atlantic Ocean. Figure 7 illustrates the regional flow pattern on Long Island.

The fractured bedrock contains fresh water but is not used as a supply source on Long Island. The Lloyd aquifer overlying the bedrock is under artesian pressure due to semi-confinement by the Raritan clay. Its use as a water supply source is generally restricted to the north and south shores where salt-water intrusion is a threat in the upper aquifers.

The Magothy Formation is the principal water supply source on Long Island and is, tapped extensively in central Nassau County. The Glacial aquifer is utilized primarily in the mid-island to north shore areas.

In the vicinity of the Ruco plantsite all of the water supply wells are completed in the Magothy Formation, the Glacial aquifer being dry or having only a thin zone of saturation. Figure 8 shows the average daily withdrawals, by well, for 1979 from the public supply wells and Grumman wells. Total public supply average daily pumpage was 11.1 mgd (million gallons per day), and Grumman pumpage was 7.2 mgd. The total withdrawal, less other minor industrial pumpages, was 18.3 mgd over the 15 square mile map area. Maximum withdrawal in 1979 was in July at 29.2 mgd, and the minimum was 12.1 mgd in December. It is not known how much of this water is returned to the aquifer via septic systems, recharge basins, or return wells. The 1982 data, shown on figure 9, indicate that Grumman cut back their pumpage to

HRC 001 0226

- EXPLANATION**
- TYPES OF GROUND-WATER DISCHARGE**
- 1 Seepage to streams
 - 2 Subsurface outflow
 - 3 Evapotranspiration
 - 4 Spring flow

General movement of fresh ground water

Fresh ground water

Salty ground water

**GROUND-WATER MOVEMENT AND DISCHARGE
ON LONG ISLAND, NEW YORK, UNDER NATURAL
CONDITIONS**

from **AN ATLAS OF LONG ISLAND'S WATER RESOURCES**
NEW YORK WATER RESOURCES COMM. BULLETIN 62, 1968

P. COHEN, ET AL

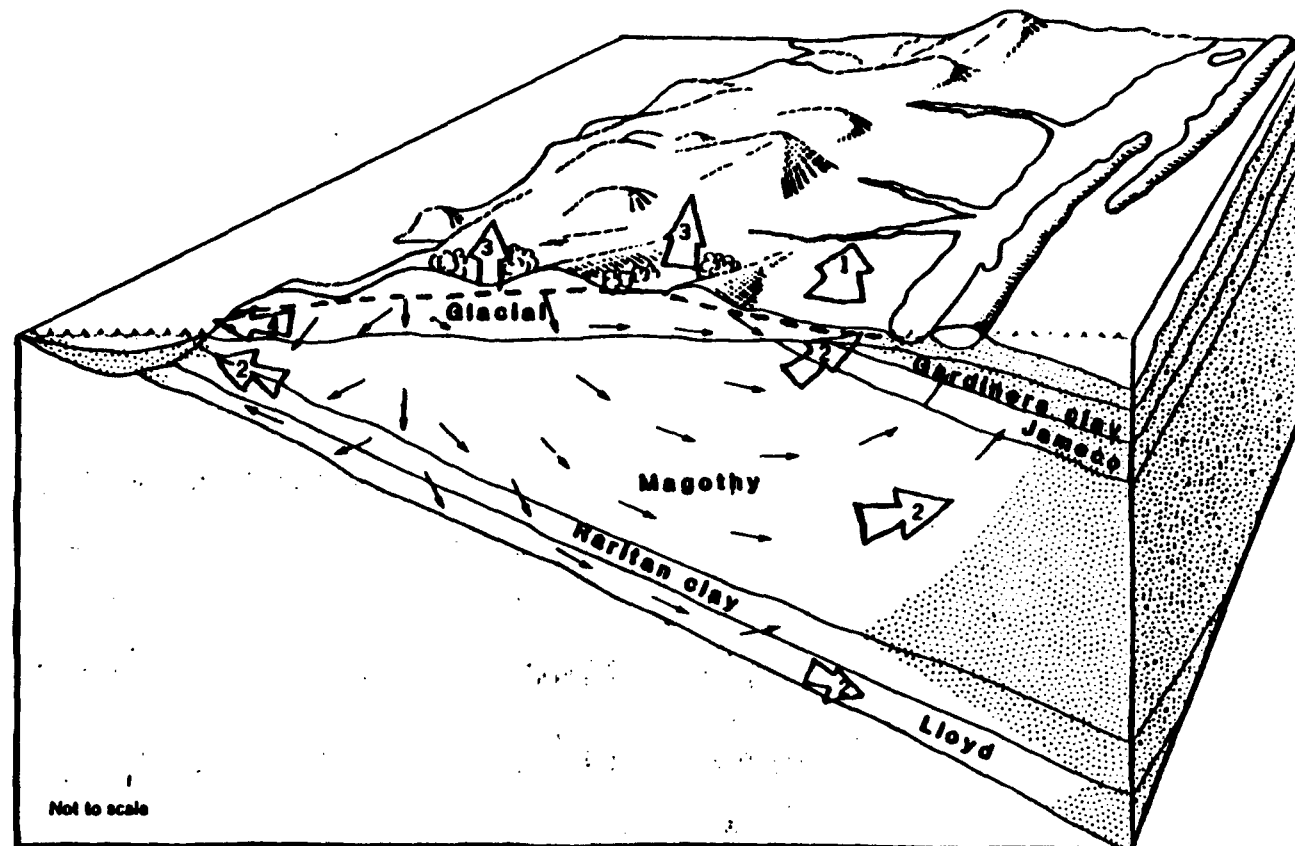
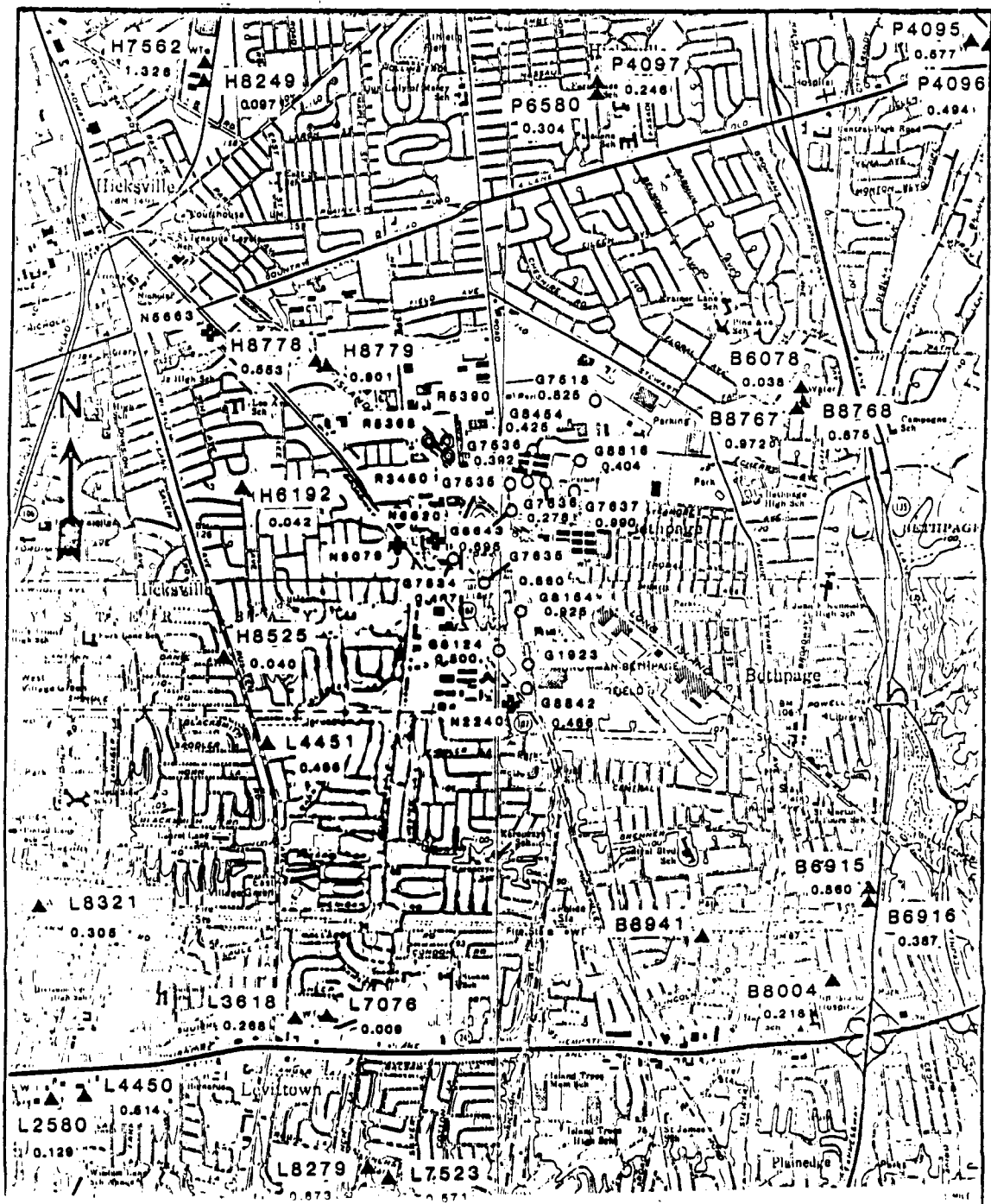


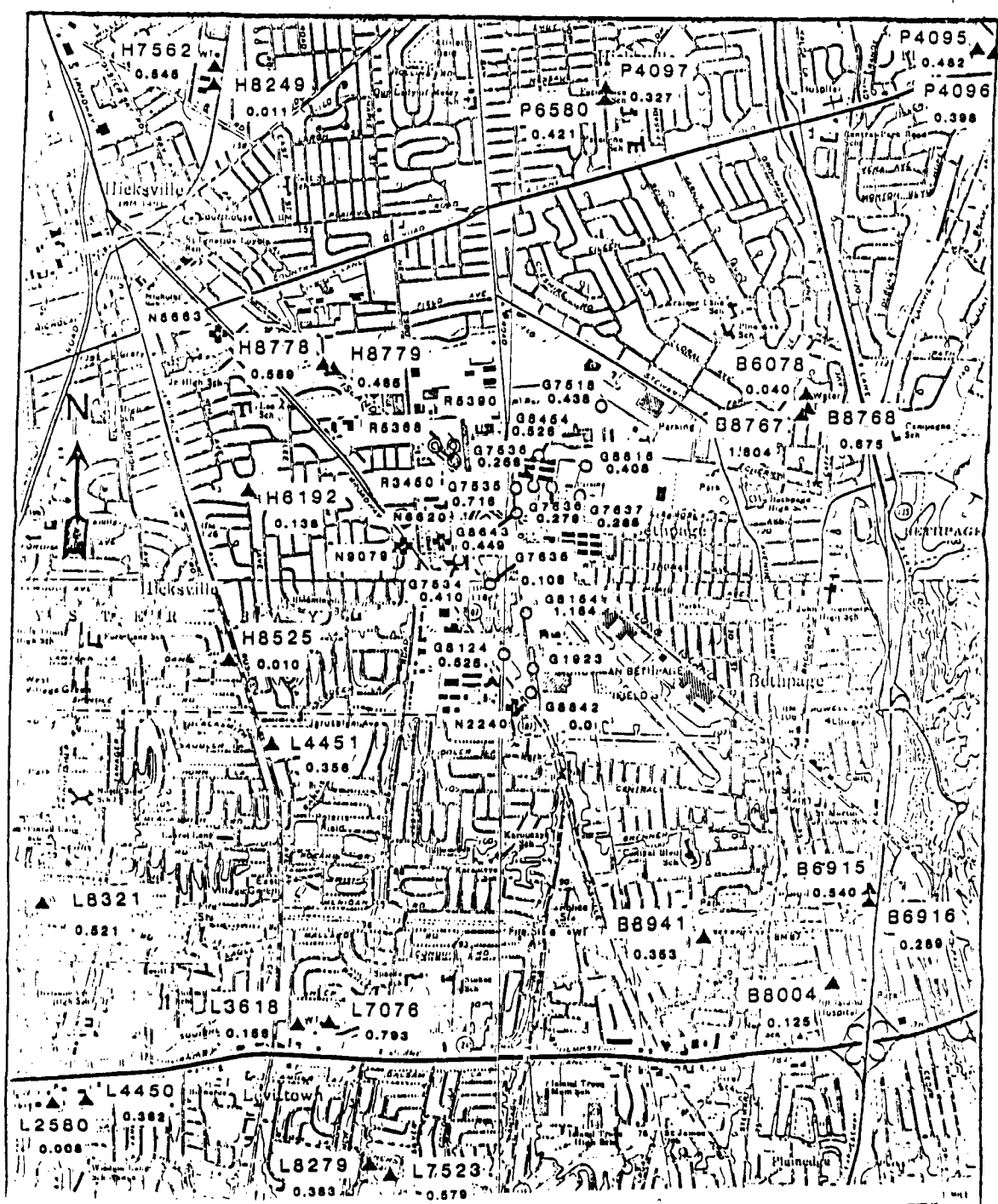
FIGURE 7

HRC 001 0227

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FORMER OCC PLANTSITE
HICKSVILLE, NEW YORK



WHITEMAN, OSTERMAN & HANNA
FORMER OCC PLANTSITE
HICKSVILLE, NEW YORK



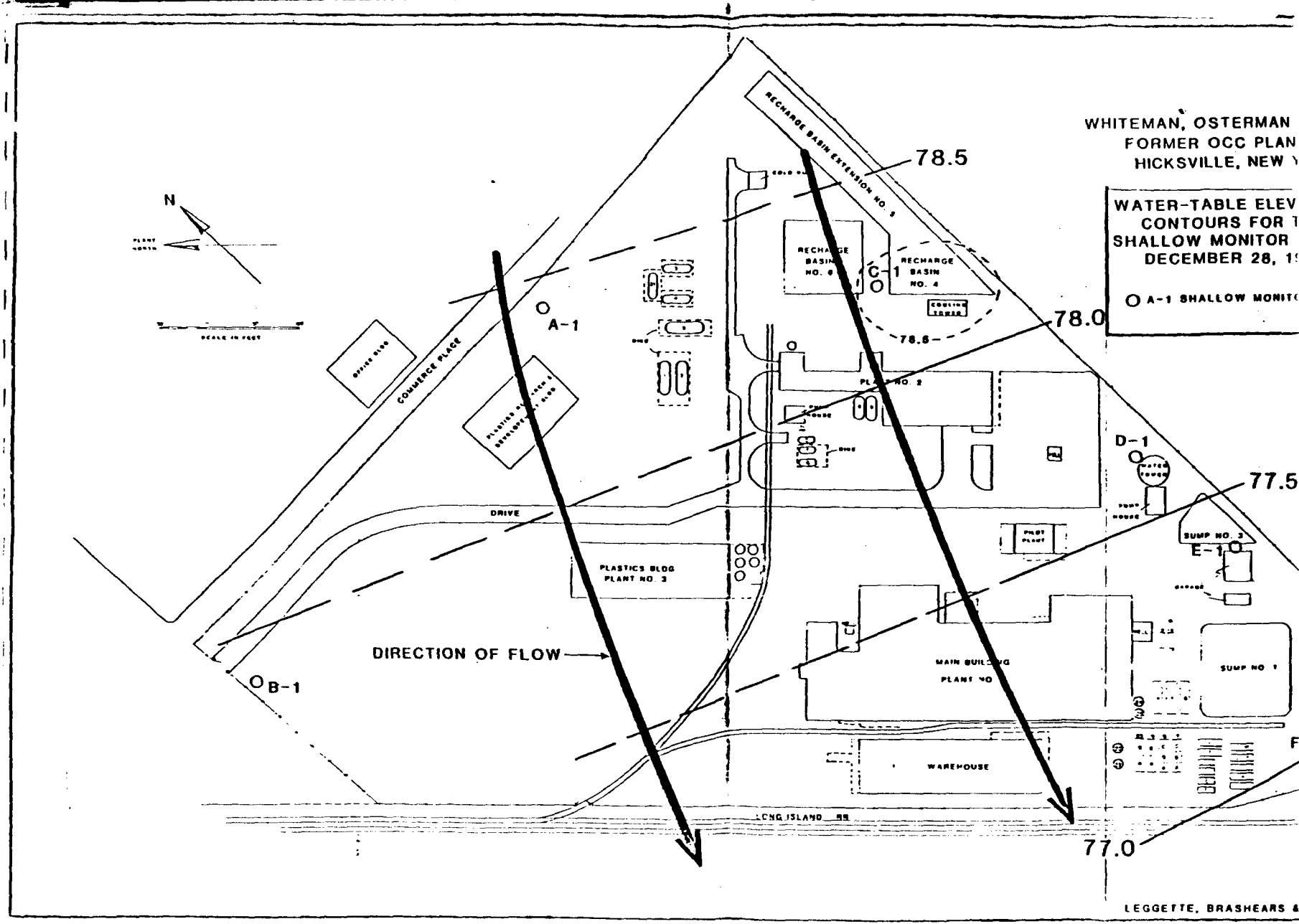
5.6 mgd (a drop of 23 percent) and the public supply pumpage was reduced to 10.4 mgd.

The ground-water system on Long Island is recharged primarily by rainfall infiltration, which is estimated to be about one million gallons per day per square mile (mgd/mi²).

Plantsite Hydrogeology

The Glacial Formation and transition zone underlying the Ruco facility are unsaturated, the water table being in the Magothy aquifer. Figure 10 shows the water-table elevation contours and direction of flow on April 30, 1984, the normal seasonal high level. The top of the Magothy Formation is at about 90 feet above sea level, which puts the high water table 9 feet below the top of this formation. It is unlikely under current water withdrawal rates that the water table ever rises into the Glacial Formation. As indicated by the flow lines on the map, the lateral component of ground-water flow is to the south-southwest at a gradient of 0.0017, or about 9 feet per mile. The high water level at Well C-1 is due to cooling-water infiltration from Recharge Basin 4, combined with lower than average sediment permeability. Figure 11 shows the water-table elevation on December 28, 1983 (the mid point between high and low levels). Figure 12 shows the most recent data (July 13, 1984) which are the highest recorded. This has been an abnormally high year for precipitation, and water levels have continued to rise well into the summer season. The flow directions and gradients are the same ~~as~~ for the three maps.

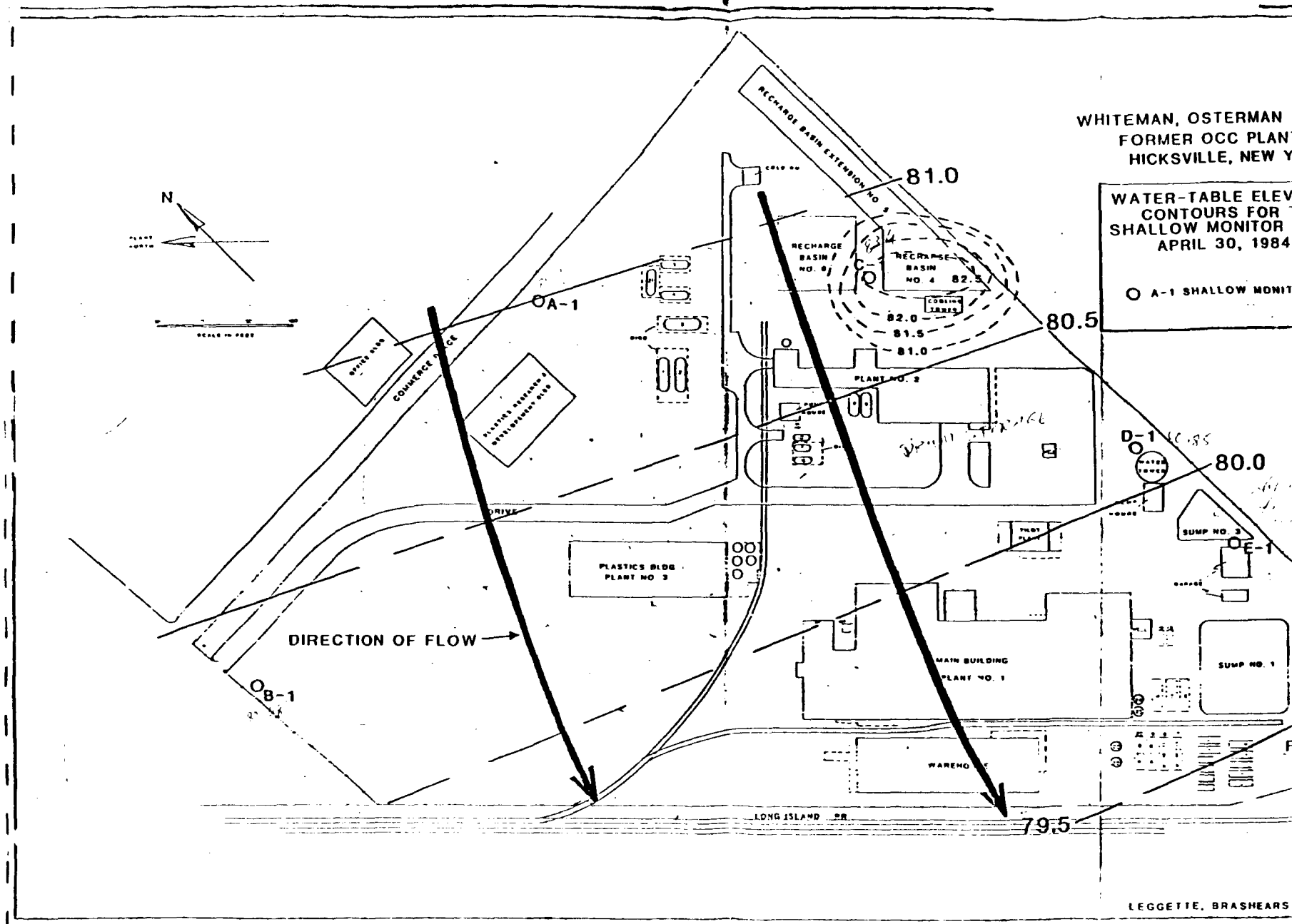
Short duration pumping tests were run on the six water-table wells using the submersible pump. Table 4 shows the transmissivity results, which range from 900 to 7300 gpd/ft (gallons per day per foot) and average 4200 gpd/ft. Permeabilities for the saturated screen zones ranged from 69 to 710 gpd/ft² (gallons per day per square foot) and average 390 gpd/ft². Assuming a specific yield of 0.20, and average



WHITEMAN, OSTERMAN &
FORMER OCC PLANT
HICKSVILLE, NEW YORK

WATER-TABLE ELEV
CONTOURS FOR 1
SHALLOW MONITOR
APRIL 30, 1984

○ A-1 SHALLOW MONIT



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WHITEMAN, OSTERMAN
FORMER OCC PLAN
HICKSVILLE, NEW Y

WATER-TABLE ELEV
CONTOURS FOR 1
SHALLOW MONITOR
JULY 13, 1984

● A-1 SHALLOW MONITOR V

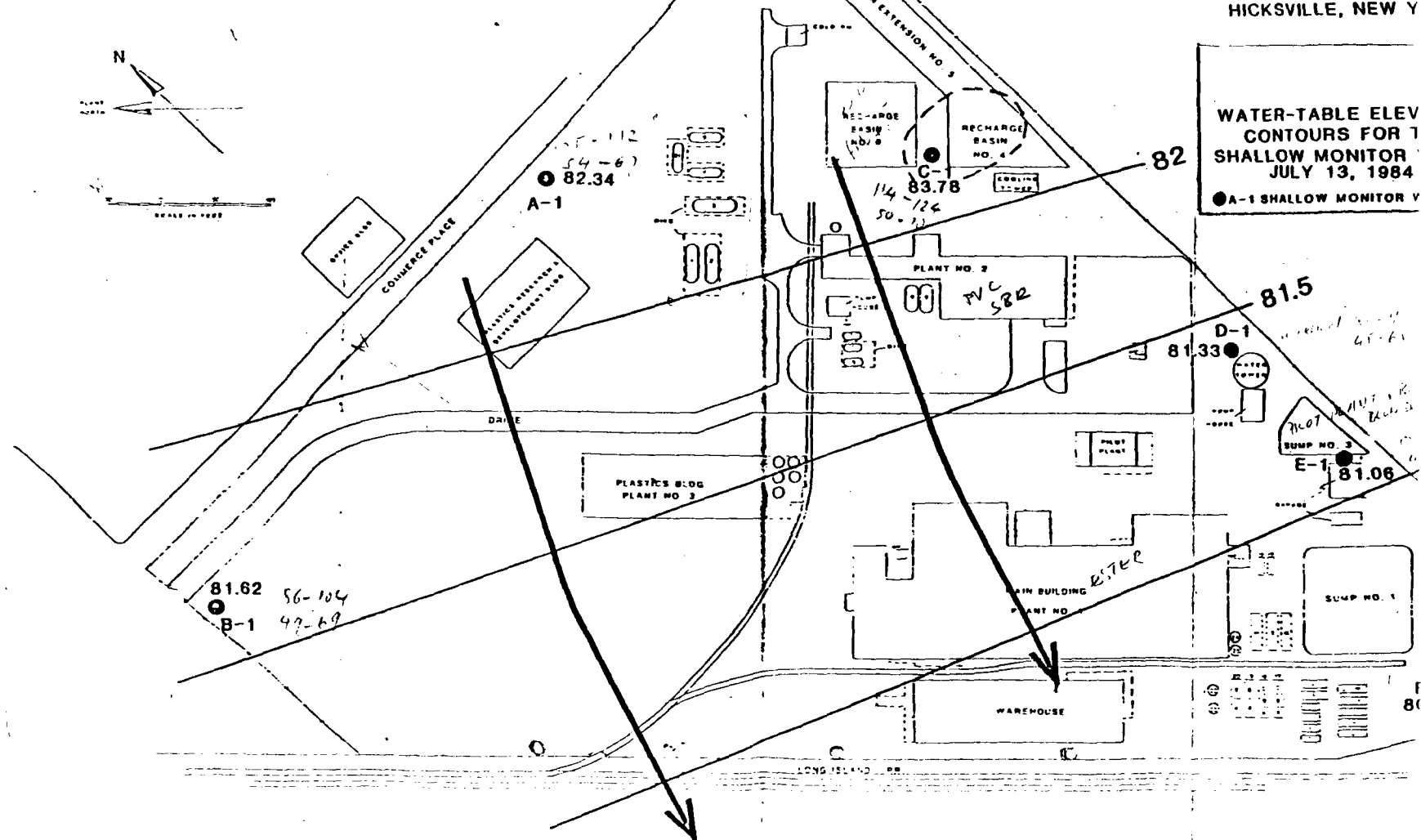


TABLE 4

OCCIDENTAL CHEMICAL CORPORATION
FORMER RUCO DIVISION PLANTSITE
HICKSVILLE, NEW YORK

Summary of Transmissivity Test Results

Well No.	Q (gpm)	Transmissivity		Saturated thickness (ft)	Permeability	
		Drawdown	t/t' Recovery (gpd/ft)		Drawdown	t/t' Recovery (gpd/ft ²)
A-1	1.20	--	4900	8	--	600
B-1	1.04	3400	4200	14.2	240	300
C-1	1.15	900	--	13.1	69	--
D-1	1.25	3100	7300	10.3	300	710
E-1	1.33	--	22900*	11.4	--	2000
F-1	1.3	--	6240	12.7	--	490

*Questionable analysis due to high transmissivity.

FRC 001 0234

permeability, the horizontal velocity of shallow ground water beneath the plantsite is 0.44 foot per day. The maximum transport velocity, assuming the highest permeability, would be 0.68 foot per day.

The water-level elevations for the deep screen zones are shown on figures 13, 14 and 15. The flow direction is more southerly than the water-table flow direction, though still slightly to the west of south. The most recent data indicate a shift in the direction of flow towards the south. This is probably due to increased ground-water withdrawals by Grumman. The gradient in the deeper zone is 0.0014 foot per foot, or 7.4 feet per mile. Permeability tests were not run on the deep wells because the pump's low capacity did not induce measurable drawdown. However, published estimates are 500 gpd/ft² as an average for the entire Magothy aquifer and 1000 gpd/ft² for the more permeable lenses. The storage coefficient is estimated at 5×10^{-4} . The average horizontal velocity for this zone is estimated to be 0.47 foot per day, and the maximum as 0.93 foot per day.

There is a downward head gradient at all of the well pairs, ranging from 0.06 foot at Site B to 0.99 foot at Site C. This latter figure is due to the mounding effect caused by the recharge basin. The average head difference between the upper and lower screen zones is about 0.15 foot, for a gradient of 0.0065 foot per foot. Water levels obtained in plant supply Well No. 1 indicate a 2.28-foot downward head between the deep monitor well screen zones and the production well screen zones, for a downward gradient of 0.050 foot per foot.

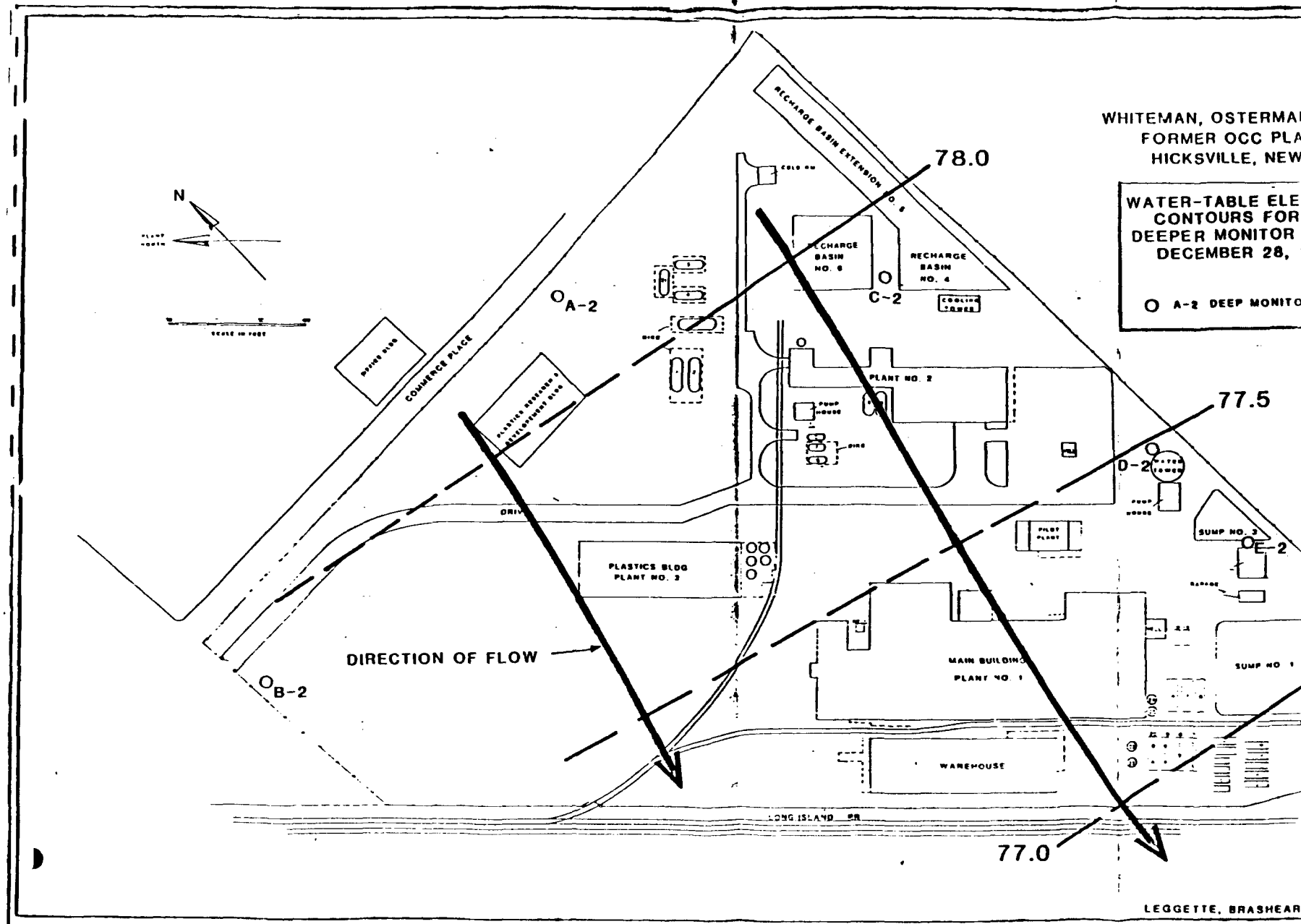
Vertical permeability was not measured directly during the field investigation. However, based on the accepted recharge rate of one million gallons per day per square mile the vertical permeability of the zone between the water table screen zones and the lower screen zones is 5.5 gpd/ft² (2.6×10^{-4} cm/sec). The vertical permeability of the zone between the deep monitor well screens and the production

HRC 001 0235

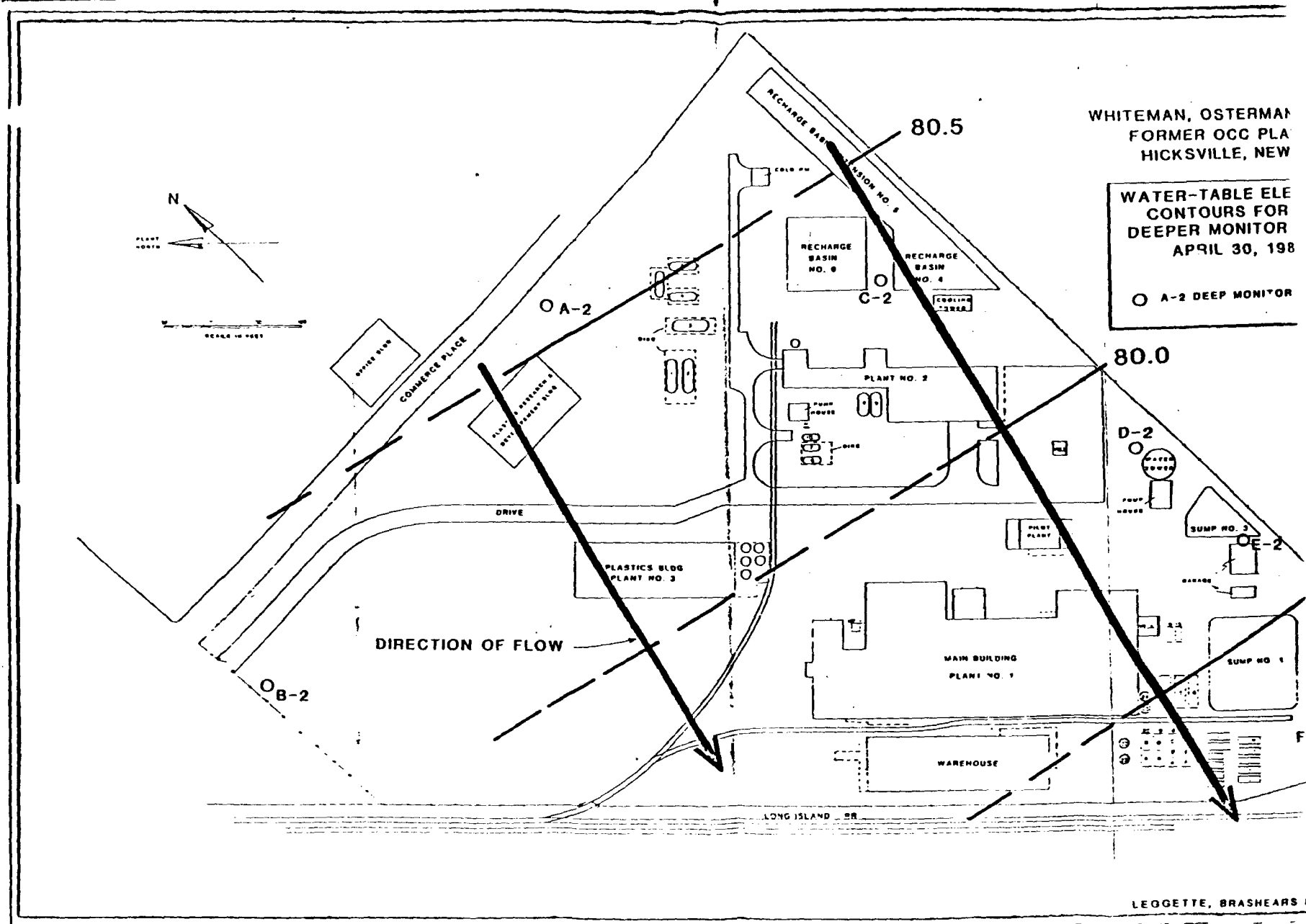
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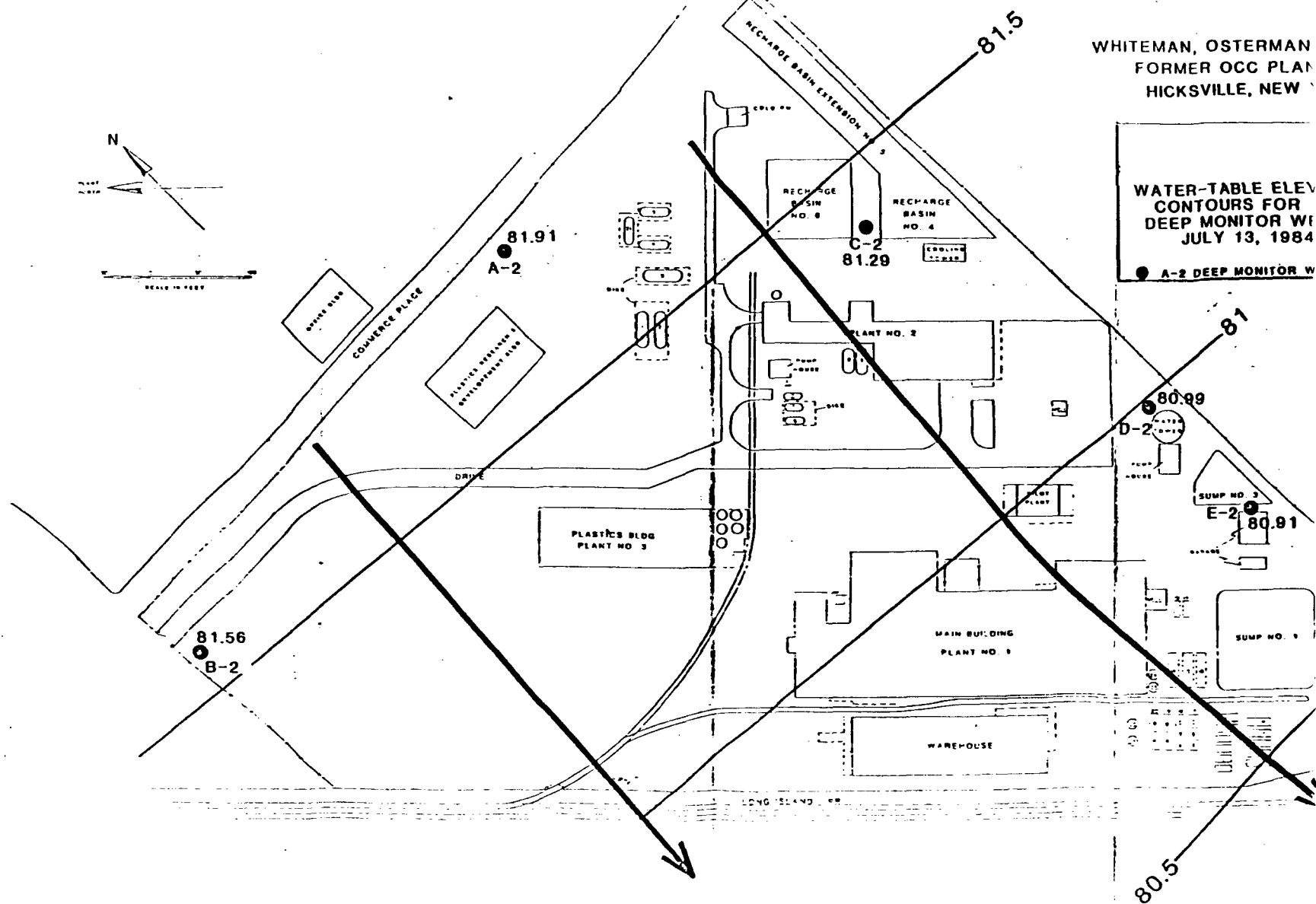
WATER-TABLE ELE
CONTOURS FOR
DEEPER MONITOR
DECEMBER 28, 1

○ A-2 DEEP MONITO



LEGGETTE, BRASHEAR





well screens is 0.72 gpd/ft^2 ($3.4 \times 10^{-5} \text{ cm/sec}$). The vertical velocity component is 0.024 foot per day. Based on the above, the ground water beneath the plantsite moves horizontally 17 feet for each vertical foot of movement.

Water levels in Well Pairs A, D and E, measured since August, indicate a seasonal fluctuation of about 7.5 feet. Hydrographs for all of the wells are shown in Appendix 2. Water-level recorders have been maintained on Wells D-1 and D-2 since April 5, 1984 and the hydrographs for these wells are shown on figure 16. The effects of pumpage are evident on several occasions, particularly on May 4. The rapid rise during the last week in May was due to the prolonged storm which occurred during this period.

Based on the ratio of horizontal to vertical flow, the water infiltrating to the water table from upgradient on-site would move downward to 58 feet below the water table by the time it moved off the plantsite. Taking the widest flow path across the plant (1250 feet), the measured permeability (350 gpd/ft^2) and the gradient (0.0017) the volume of flow affected by plant activity would be about 44,000 gallons per day. This is in good agreement with the recharge rate of 46,000 gallons per day for the area contributing to this flow. However, only about 27,000 gallons per day are generated through infiltration on plant property. This does not include recharge from the sumps.

With the current network of on-site measuring points it is not possible to determine the ultimate fate of the ground water emanating from the Ruco plantsite. However, based on the magnitude of pumpage from the Grumman well field it is likely that this is the discharge point for that ground water.

The nearest downgradient public supply well is 6300 feet away and somewhat offset from the direction of groundwater flow. If Grumman were to discontinue pumping from their wells south of Ruco, or if the Grumman wells do not

totally contain this flow, it is conceivable that the affected ground water could flow towards this, or other, supply wells. However, the dilution and attenuation factors over this flow distance, though unquantifiable, are considered to be sufficient to render the levels of identified compounds at Ruco nondetectable at this discharge point.

HRC 001 0240

WHITEMAN, OSTERMAN & HANNA
 FORMER OCC PLANTSITE
 HICKSVILLE, NEW YORK
 WATER-LEVEL HYDROGRAPHS FOR WELLS
 D-1 AND D-2, APRIL 5 TO MAY 31, 1984

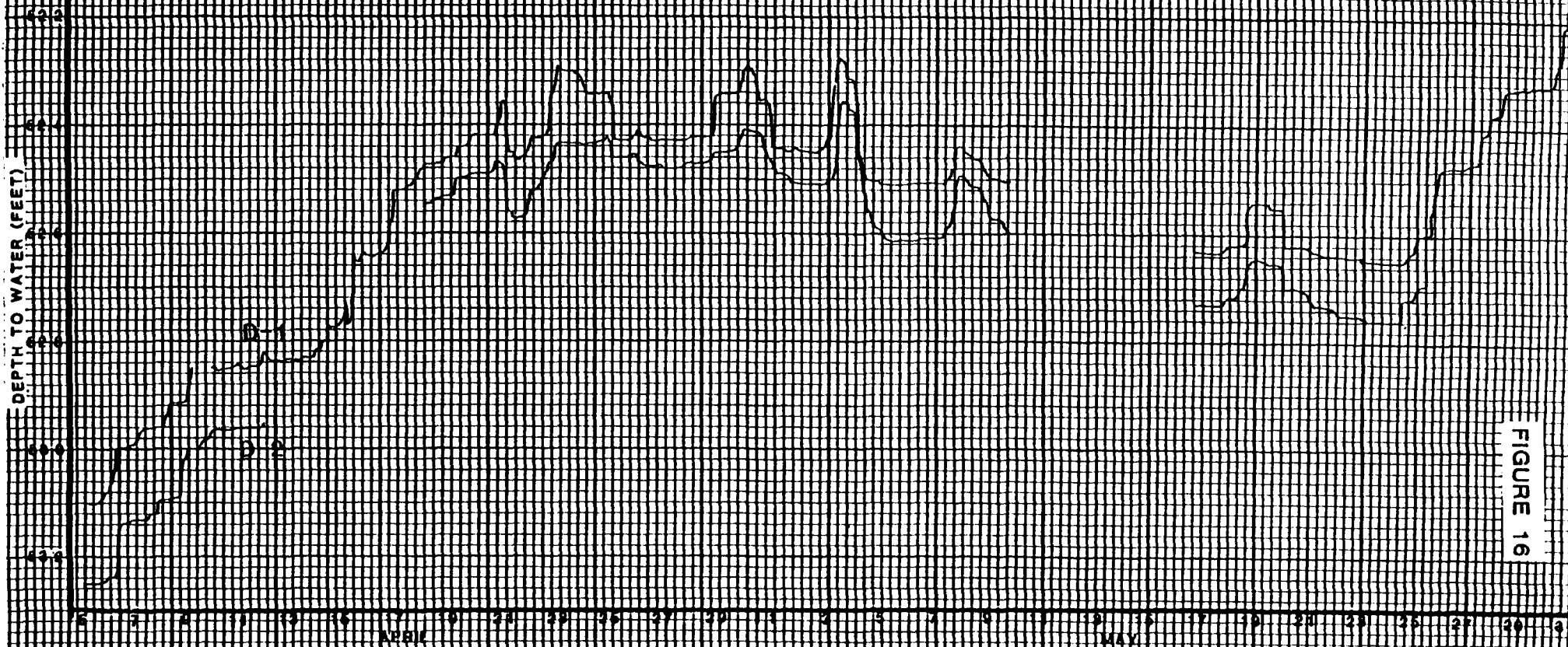


FIGURE 16

ANALYTICAL DATA REVIEW

The following discussion is based on analytical data provided by Occidental Chemical Corporation as analyzed by Environmental Testing and Certification. Technical aspects of the analytical techniques and quality control are included in Section III of this report. The parameters analyzed for in both the soil and water samples were chosen to reflect the impact of former operations on the soil and ground water based on company records of disposal practices.

Site A - The soil column at this upgradient location, as evidenced by analyses of split-spoon samples at depths of 5, 25 and 50 feet below grade, contains none of the substances analyzed for, except that the sample from 5 feet contained total phenolics of 64 ug/l (just over the detection limit).

The shallow ground water from Well A-1 contained nitrates of 13 mg/l. None of the other inorganic parameters were at levels of note and none of the organic chemicals analyzed for were detected. Ground water from adjoining Well A-2 (50 feet below the water table) contained only trichloroethylene at 25 ug/l. Since the ground water in this well originates 500 to 1000 feet to the north of the facility, and because trichloroethylene is not present in the soil or shallow ground water at this location, it is concluded that there is an off-site source of this chemical.

Site B - Only tetrachloroethylene of the organic chemicals tested was found in the soil at this upgradient location. It was detected in the soil sample from 5 feet below grade at 310 ug/kg. This substance was not present in the 25-foot sample. The ground water contained none of the organic chemicals tested, and none of the inorganic parameters were at levels of note.

RRC

001 0242

Site C - The soil samples from this location were taken from the middle of the partially filled Recharge Basin No. 6. The soil sample from zero to one and one-half feet below grade contained tetrachloroethylene at 367 ug/kg. This substance was not detected in the lower soil samples or in the shallow ground water. However, it is present in the deeper well (C-2, 70 feet below the water table) at a concentration of 50 ug/l. Because this water originates from a considerable distance to the north of the property, and because it is not present in the deep soil or shallow ground water, it is concluded that there is an off-site source of this substance. None of the other organic substances tested for were present in the ground water. None of the inorganic parameters were found at significant levels. However, the chemical oxygen demand in Well C-1 was 13 mg/l, while the background values are 3 to 4 mg/l.

Aroclor 1248 was detected in the soil sample from 25 feet at 530 ug/kg and at 120 ug/kg in the 50-foot sample. It was not detected in the water at this site.

Site D - The soil column at this site contained none of the organic chemicals analyzed. Aroclor 1248 was present in the soil sample from 5 feet below grade at 210 ug/kg, but was not detected at lower depths.

The ground water in Well D-1 contained tetrachloroethylene at 160 ug/l, trichloroethylene at 16 ug/l and 1,2 transdichloroethylene at 24 ug/l. The chemical oxygen demand is 9 mg/l. The water in this well originates from the well location to about 250 feet upgradient. Because the property line is 90 feet upgradient these substances could have originated on-site, off-site or both. It has already been established that there is an off-site source of tri-chloroethylene (A-2), and that there may be an off-site source of tetrachloroethylene (C-2).

HRC 001 0243

None of the organic substances tested were in the water from Well D-2. The inorganic substances tested were not at levels of note.

Site E - In the upper soil sample obtained at this site (0.5 to 2.0 feet below grade) tetrachloroethylene was found at a concentration of 244,000 ug/kg. At a level of 5 feet below grade, this substance was detected at 1070 ug/kg and at 25 feet was 164 ug/kg. It was not detected in the lower soil sample or in the ground water in either well. None of the inorganic substances analyzed were present at levels of note.

Aroclor 1248 was detected in the upper sample at this location at 940 ug/kg, at 5 feet at 180 ug/kg, at 25 feet at 100 ug/kg and at 50 feet it was found at 270 ug/kg. This substance was not detected in the ground water, which is not surprising in view of its low solubility in water. The field observations during sampling of both Wells E-1 and E-2 indicate that a film of material was present in the discharge water.

The shallow ground water (Well E-1) exhibited 30 ug/l of 1,2 dichloroethylene and 7 ug/l of vinyl chloride. The total organic carbon is elevated above background levels (2 mg/l) at a level of 8.2 mg/l. The pH is in the normal range at 6.7. Chemical oxygen demand (background 3 to 4 mg/l) was measured at 25 mg/l.

The water from the deeper well (25 to 40 feet below the water table) did not exhibit any of the organic chemicals tested. However, the total organic carbon was elevated to a level of 8.7 mg/l, the C.O.D. was 15 mg/l, the pH was abnormally high at 8.8, and the field notes indicate that a film of oily material and some entrained gas were observed during sampling.

HRC 001 0244

None of the inorganic parameters tested were at levels worthy of note in either the shallow or deep ground water.

The water in Well E-1 originates from the adjacent sump, localized infiltration, and upgradient areas. Upgradient ground water originating from as far as 250 feet away may effect this well, and the property line appears to be about 75 feet upgradient. The ground water in E-2 may be affected by infiltration from the sump, and may also originate from as far upgradient as 680 feet.

Site F - Soil samples from this site were obtained from the bottom of Sump No. 2, which is about 16 feet below grade, as well as from the well site which is located on the south edge of the sump, about 75 feet downgradient of the boring site. The soil samples from the well site, taken from 40 and 65 feet below grade (24 and 49 feet below the sump bottom) exhibited none of the organic parameters tested.

The soil samples in the sump bottom taken from one, 20 and 30 feet contained lead at levels of 0.26, 0.12 and 0.11 mg/l, respectively. There was no lead detected in the ground water at either Well F-1 or F-2. None of the other inorganic parameters were found at levels of note.

The samples from 20 feet and 30 feet contained tetrachloroethylene at levels of 1700 and 120 ug/kg, respectively, but this substance was not detected in the ground water at this location.

The shallow ground water at this site (Well F-1) contained 130 ug/l of 1,2 transdichloroethylene and 140 ug/l of vinyl chloride. The chemical oxygen demand and the total organic carbon were well above background levels at 46 and 22 mg/l, respectively. Observations during sampling indicate a sheen and some entrained gases.

The deeper ground water from Well F-2 exhibited 200 ug/l of 1,2 transdichloroethylene and 50 ug/l of vinyl chloride. The C.O.D. and T.O.C. were elevated to 66 and 14

mg/l, respectively. Observations during sampling indicate a sheen and substantial amounts of entrained gases.

None of the inorganic parameters were found at levels of note in either well.

Although some of the water in Well F-2 may be derived from off-site, the levels of contaminants in the F wells in conjunction with the present hydraulic gradients (directly downgradient from Site E) suggest that the chemicals detected originated, in whole or in part, from on-site sources. Discharges from Sump Nos. 1 and 2 would affect ground water at this location. This conclusion is based on the current hydraulic gradients and directions of flow. Past operations, both on and off-site, could have had a substantial effect on hydrologic conditions. Specifically, past on-site pumpage, off-site recharge of water and alterations of pumping patterns, could have had a substantial impact on the hydrologic regime. Off-site data are necessary to better understand the ground-water flow patterns in this area of the plant.

Based on the present level of knowledge concerning the on-site hydrogeology, the presence of vinyl chloride cannot be explained at this location. However, LBG is aware of ongoing research concerning the biodegradation of the family of chloroethylenes leading to the production of monochloroethylene (vinyl chloride).

HRC 001 0246

THERMINOL AREA ANALYTICAL DATA

Table 5 presents the results of the tests run on soil samples taken at the Therminol Area. The data are self explanatory and indicate that the upper soil at all four boring locations is contaminated with Aroclor 1248. In general, the larger concentrations correspond to visual identification of a black, oily to tar-like substance binding the soil. Additional borings taken to 6.5 feet below grade will be installed to further define the areal extent of this problem.

HRC 001 0247

OCCIDENTAL CHEMICAL CORPORATION
FORMER RUCO DIVISION PLANTSITE
HICKSVILLE, NEW YORK

Hicksville Soil From Therminol Spill Area
Analyses by Environmental Testing and Certification Corporation

Site	Depth (ft.)	ETC No.	Aroclor Number (concentrations in mg/kg)						
			1061	1221	1232	1242	1248	1254	1260
W	1	C5313	ND ₅₀₀	ND ₅₀₀	ND ₅₀₀	ND ₅₀₀	20,000	ND ₅₀₀	ND ₅₀₀
	1 - 2.5	C5314	ND ₅₀₀	ND ₅₀₀	ND ₅₀₀	ND ₅₀₀	2,200	ND ₅₀₀	ND ₅₀₀
	2.5 - 4	C5315	ND ₅₀	ND ₅₀	ND ₅₀	ND ₅₀	ND ₅₀	ND ₅₀	ND ₅₀
	4 - 5.5	C5316	ND _{0.5}	ND _{0.5}	ND _{0.5}	ND _{0.5}	3.3	ND _{0.5}	ND _{0.5}
	5.5 - 7	C5317	ND _{1.0}	ND _{1.0}	ND _{1.0}	ND _{1.0}	13	ND _{1.0}	ND _{1.0}
	7 - 8.5	C5493	ND _{0.5}	ND _{0.5}	ND _{0.5}	ND _{0.5}	7.0	ND _{0.5}	ND _{0.5}
	8.5 - 10	C5494	ND _{2.5}	ND _{2.5}	ND _{2.5}	ND _{2.5}	21	ND _{2.5}	ND _{2.5}
X	0.5 - 1.0	D5475	ND ₅₀₀	ND ₅₀₀	ND ₅₀₀	ND ₅₀₀	23,000	ND ₅₀₀	ND ₅₀₀
	1.0 - 2.5	D5476	ND ₅₀	ND ₅₀	ND ₅₀	ND ₅₀	1,300	ND ₅₀	ND ₅₀
	2.5 - 4.0	D5477	ND _{1.0}	ND _{1.0}	ND _{1.0}	ND _{1.0}	21	ND _{1.0}	ND _{1.0}
	4.0 - 5.5	D5478	ND _{2.5}	ND _{2.5}	ND _{2.5}	ND _{2.5}	54	ND _{2.5}	ND _{2.5}
	5.5 - 7.0	D5479	ND _{1.0}	ND _{1.0}	ND _{1.0}	ND _{1.0}	8.6	ND _{1.0}	ND _{1.0}
	7.0 - 8.5	D5499	ND ₅	ND ₅	ND ₅	ND ₅	18	ND ₅	ND ₅
	8.5 - 10.0	D5501	ND _{0.5}	ND _{0.5}	ND _{0.5}	ND _{0.5}	10	ND _{0.5}	ND _{0.5}
Y	1 - 2.5	D5481	ND ₅₀₀	ND ₅₀₀	ND ₅₀₀	ND ₅₀₀	11,000	ND ₅₀₀	ND ₅₀₀
	2.5 - 4.0	D5482	ND ₅₀	ND ₅₀	ND ₅₀	ND ₅₀	500	ND ₅₀	ND ₅₀
	4.0 - 5.5	D5483	ND _{1.0}	ND _{1.0}	ND _{1.0}	ND _{1.0}	30	ND _{1.0}	ND _{1.0}
	5.5 - 7.0	D5484	ND _{0.5}	ND _{0.5}	ND _{0.5}	ND _{0.5}	11	ND _{0.5}	ND _{0.5}
	7.0 - 8.5	D5498	ND _{1.0}	ND _{1.0}	ND _{1.0}	ND _{1.0}	7.2	ND _{1.0}	ND _{1.0}
	8.5 - 10.0	D5499	ND _{1.0}	ND _{1.0}	ND _{1.0}	ND _{1.0}	7.0	ND _{1.0}	ND _{1.0}
Z	0.5 - 2.0	C5434	ND ₅₀₀	ND ₅₀₀	ND ₅₀₀	ND ₅₀₀	22,000	ND ₅₀₀	ND ₅₀₀
	2.0 - 3.5	C5435	ND ₅₀₀	ND ₅₀₀	ND ₅₀₀	ND ₅₀₀	7,300	ND ₅₀₀	ND ₅₀₀
	3.5 - 5.0	C5436	ND ₅₀	ND ₅₀	ND ₅₀	ND ₅₀	1,900	ND ₅₀	ND ₅₀
	5.0 - 6.5	C5437	ND _{2.5}	ND _{2.5}	ND _{2.5}	ND _{2.5}	87	ND _{2.5}	ND _{2.5}
	6.5 - 8.5	C5438	ND _{2.5}	ND _{2.5}	ND _{2.5}	ND _{2.5}	28	ND _{2.5}	ND _{2.5}
	8.5 - 10.0	C5480	ND _{1.0}	ND _{1.0}	ND _{1.0}	ND _{1.0}	35	ND _{1.0}	ND _{1.0}

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REGIONAL WATER QUALITY

Water-quality data obtained from the Nassau County Department of Health are presented on figure 17. This map shows the maximum reported concentrations of di, tri and tetrachloroethylenes. Wells remote from both Ruco and Grumman have exhibited dichloroethylene concentrations as high as 14 ug/l, trichloroethylene as high as 26 ug/l and tetrachloroethylene as high as 100 ug/l. Clearly these substances are ubiquitous throughout the area and cannot be attributable to a single source. Similarly, many Grumman wells to the east of Ruco (which would not receive groundwater flow from Ruco) contain levels of these same substances as high as 18, 480 and 50 ug/l, respectively. Ground water flowing beneath Ruco from upgradient properties may, therefore, contain these contaminants.

HRC 001 0249

RECOMMENDATIONS

1. Additional Sampling: Only one round of ground-water samples has been obtained from the existing monitor wells. In view of the levels of substances present, a second set of samples should be obtained for verification of analytical results.

2. Therminol Spill Area: Although the vertical extent of PCB contaminated soil has been determined at Soil Boring Sites W, X, Y, and Z, the areal extent has not been defined. Sites S, T, U, and V (shown on figure 18) are located an additional 10 feet away from the source of contamination.

3. Representatives of the NYSDEC should be invited to observe the additional sampling of both the wells and the therminol area soils. Provisions for splitting all samples should be made for regulatory verification of results.

LEGGETTE, BRASHEARS & GRAHAM, INC.

Robert Lamonica

Robert Lamonica
Associate



dmt
August 22, 1984
Disk: r16a

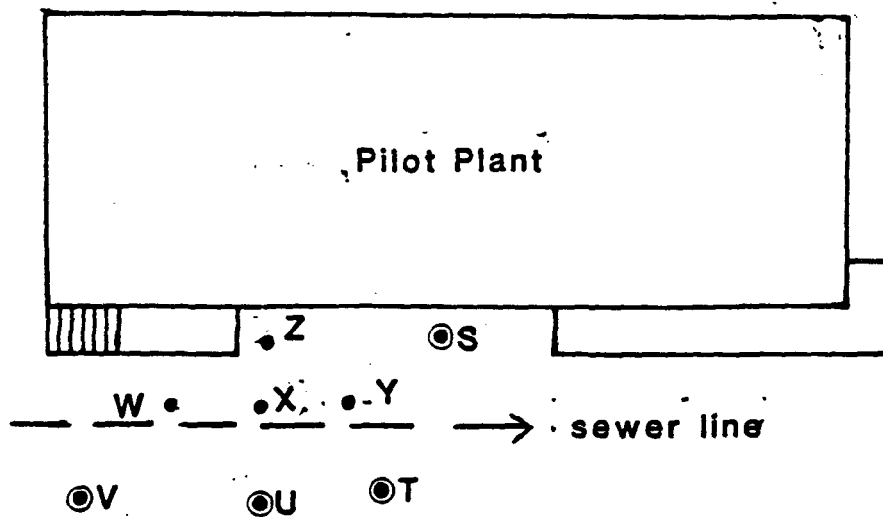
HRC 001 0250

FIGURE 18

WHITEMAN, OSTERMAN & HANNA
FORMER OCC PLANTSITE
HICKSVILLE, NEW YORK

LOCATIONS OF PILOT PLANT BORINGS
AND PROPOSED ADDITIONAL BORINGS

1 inch = 20 feet



LEGEND

● PILOT PLANT BORINGS

⊙ PROPOSED ADDITIONAL BORINGS

Plant #1